EL-MOASSER

GPS

Interactive E-learning Application

# BIOLOGY

By A Group Of Supervisors

Main Book

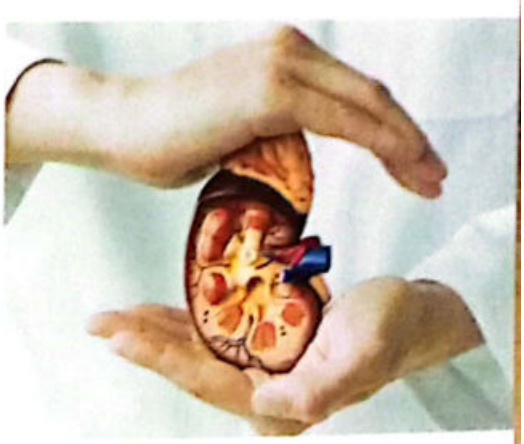
2nd SEC. 2024

SECOND TERM

# CONTENTS

## Structure and Function in Living Organisms

### Chapter 4 Excretion in Living Organisms





### Chapter 5 Sensitivity in Living Organisms



## Monthly Tests

- **10 General Exams :**
  - (1 : 5) El-Moasser Exams.
  - (6 : 10) Final Exams of some Educational Administrations.

**Why** do you think, the sweating rate is higher in hot weather than cold weather ?

Chapter **4**

Lesson One

# • Excretion in Animal.
# • Excretion in Man (Skin).

**The importance of excretion :**

- All the biological processes that occur in the body of all living organisms are carried out through the chemical reactions that leave some waste products.
- The living organism must get rid of these waste products continuously as soon as they are formed, as their accumulation inside the body causes many problems and diseases, this occurs through the process of **excretion**.

## Excretion

It is a vital process by which the living organism gets rid of the waste products that are produced from the biological processes (harmful metabolic products) and the chemical reactions that accompanied with them.

## Excretion in animal

**Materials that leave the body**

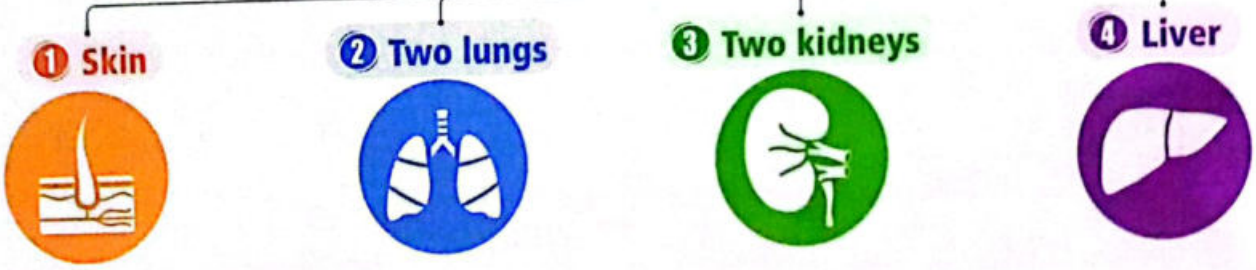
- **They pass through the plasma membranes of cells. So, getting rid of them is considered as excretion by the scientific concept, such as :**
  - **Water and $CO_2$** that are produced from the degeneration of organic molecules.
  - **Nitrogenous wastes**, like ammonia, urea and uric acid which result from protein degradation.
- **They don't pass through the plasma membranes of cells. So, getting rid of them isn't considered as excretion by the scientific concept, such as :**
  - **The undigested food** that goes out from the animal body in the form of faeces.
  - **The nitrogen** which enters the two lungs in the inspiration (inhalation) process and leaves them in the expiration (exhalation) process.

**i.e.** The excretion process is restricted only on the materials that pass through the plasma membranes to leave the body.

## Do you know ... ?

- Vertebrates get rid of the nitrogenous wastes in different forms that depend on the type of the animal environment :
  - **Aquatic animals** excrete ammonia that is highly soluble in water.
  - **Amphibians and mammals** excrete urea.
  - **Insects, reptiles** and **birds** excrete uric acid which is an insoluble compound that exits in the form of crystals.

**The important excretory organs in the bodies of higher animals are :**



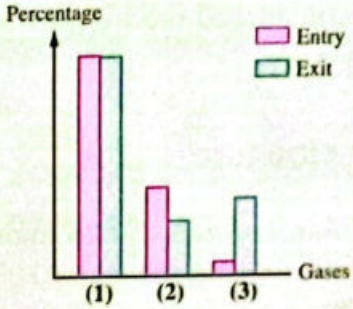

- **Functions of the excretory organs in the bodies of higher animals :**
  1. Disposal of damaged and poisonous materials.
  2. Regulation of the body contents of water and minerals.

## 1 Test yourself

Answered

**Choose the correct answer :**

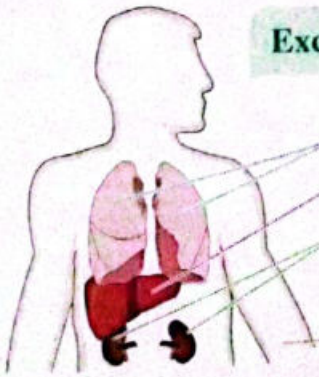
From the opposite graph, which gas(es) go(es) through the plasma membranes during its/their exit from the two lungs ?




(a) (1) and (2). (b) (2) only.
(c) (1) and (3). (d) (3) only.

## Excretion in man

- **The following figure shows the important excretory materials (wastes) that are produced in the human body and the responsible organs for their excretion :**



| Excretory organs | Excretory materials |
|---|---|
| Two lungs | Carbon dioxide, water, volatile substances of spices. |
| Liver | The poisonous materials. |
| Two kidneys | Water, salts, nitrogenous wastes and spices. |
| Skin | Water, salts and nitrogenous wastes (small percentage). |

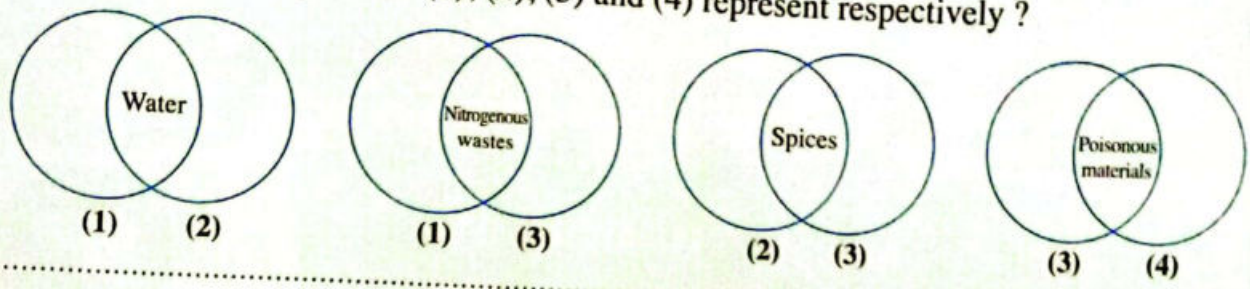
**Note**

The poisonous materials are transformed into non-poisonous or insoluble forms by the liver or the two kidneys.

## 2 Test yourself

Answer

In the following figures, each two organs share in the excretion of some wastes from the body, **what** do organs no. (1), (2), (3) and (4) represent respectively ?




.....

**We will study in detail some of the important excretory organs in man, as follows :**

## First Skin

- It is considered the **biggest organ** in the body, as it covers the whole body and limbs from outside.

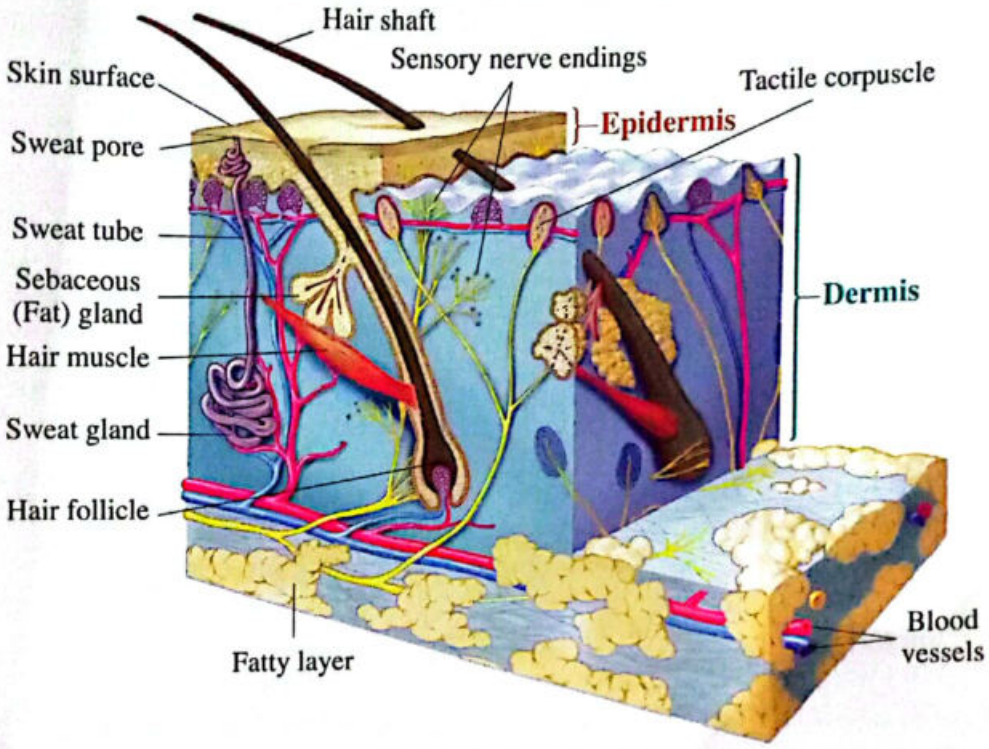
### Skin structure

- The skin consists of two main layers **which are :**

1 **Epidermis** consists of → The surface layer, The inner layer

2 **Dermis** contains → Sweat and sebaceous (fat) glands, Hair follicles and hair muscle, Sensory nerve endings, Blood vessels, Fatty cells

- The skin adheres to the body by a fatty layer that is present under the dermis.




Section in the human skin

## 1 Epidermis

- **It consists of several layers of epithelial cells, the most important ones are :**

### A The surface layer

- It **consists** of dead (non-living) cells that are full of a horny substance called **keratin**, which works on protecting the body against the invasion of microbes.
- It **arises** from the migration of the inner epidermal layer cells (which are responsible for its formation) to the outer surface, then die.
- It is **worn out** and continually compensated from the beneath layer, because it is always subjected to friction (on wiping your face or body with a towel or rubbing your hands together).

### B The inner layer

- It **consists** of living cells that compensate the surface (horny) layer with the continuous replacement.
- Its base **contains** pigment cells which secrete granules called **melanin** that are responsible for giving the skin its colour.

### Key Point

The skin colour differs from one person to another, this is because the pigment cells that exist in the inner layer of the epidermis produce unequal quantities of melanin granules, which give the skin its colour and these quantities are different from a person to another.

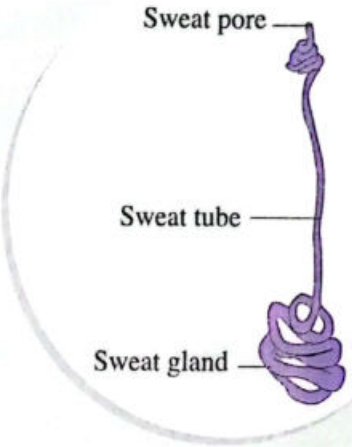
## 2 Dermis

- **It lies beneath (follows) the epidermis, consists mainly of connective tissues and contains :**

Sweat and sebaceous (fat) glands | Hair follicles and hair muscle | Sensory nerve endings | Blood vessels | Fatty cells

### A Sweat gland

- It is the functional unit of excretion in skin.
- **Its structure :**
  It consists of a thin tube that is coiled around itself, and reaches the skin surface (in the epidermal layer) through pores called "sweat pores".
- **Its function :**
  It extracts the sweat (water, salts and small amount of nitrogenous wastes) from the blood and this sweat is evaporated on the skin surface, to decrease the body temperature.




**Notes**

**(1) The rate of sweating :**

- **Increases, when :**
  - The weather is hot, as increasing the temperature leads to the dilation of the blood capillaries and activating the sweat glands to extract the excess water, salts and also a small amount of nitrogenous wastes from the blood for expelling them out in the form of sweat.
  - Performing physical activities that cause the rapid arrival of blood to sweat glands, in addition to increasing the body temperature.
- **Decreases, when** the weather is cold, due to the constriction of the blood capillaries in the dermis, as the blood reaching the sweat glands decreases.
- The sweat secretion continues, despite the cold weather, due to the continuous blood supply to the sweat glands that continue their excretion role.

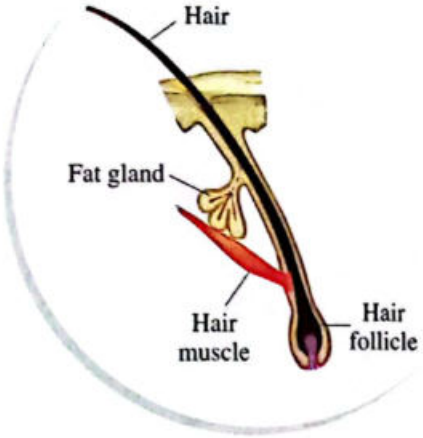
**(2) It is important to remove the remaining wastes from sweat continually by washing :**

- In order not to remain these wastes that make the skin (body) sticky and block the sweat pores.
- To avoid the foul (unpleasant) odour that results from their accumulation.

## B Hair

- It consists of a hair follicle surrounded by many blood capillaries.
- It is connected with an erector muscle to move it, when it contracts.
- Near its free end (or around it), there is a sebaceous (fat) gland which produces an oily secretion,

**To :** - Facilitate the exit of hair from the skin.
- Keep the hair soft and pliable.




## C Sensory nerve endings

- They respond to touch, pain, pressure and temperature.

## Key Point

**Skin**

- **An excretory organ:** makes the body get rid of some excretory substances.
- **An immune organ** : protects the body from the invasion of microbes.
- **A sensory organ** : due to the presence of the sensory nerve endings that respond to pressure, pain and temperature.

## 3 Test yourself

Answered

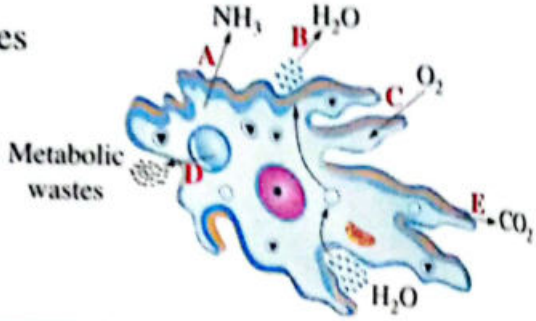
**Choose the correct answer :**

When the skin is exposed to cold weather, which of the following physiological changes happen to the skin blood capillaries and the sweat secretion rate respectively ?

(a) Dilate / Decreases.
(b) Constrict / Decreases.
(c) Dilate / Increases.
(d) Constrict / Increases.

## First Multiple Choice Questions

**1** The opposite figure represents one of the protozoans *(Amoeba)*, which of the following biological processes represents the excretion process ?




ⓐ (A), (B) and (E).
ⓑ (B), (C) and (D).
ⓒ (C), (D) and (E).
ⓓ (B), (A) and (C).

**2** Which of the following is a reason for birds to get rid of the nitrogenous wastes in the form of uric acid with the faeces ?

ⓐ Getting rid of the excess water.
ⓑ Maintaining the water content in the body.
ⓒ Getting rid of the excess temperature.
ⓓ Maintaining the constancy of the body temperature.

**3** Which of the following substances is(are) excreted from the body by one organ only and **no** organ participates with it ?

ⓐ Water and mineral salts. ⓑ Urea.
ⓒ Spices. ⓓ Carbon dioxide.

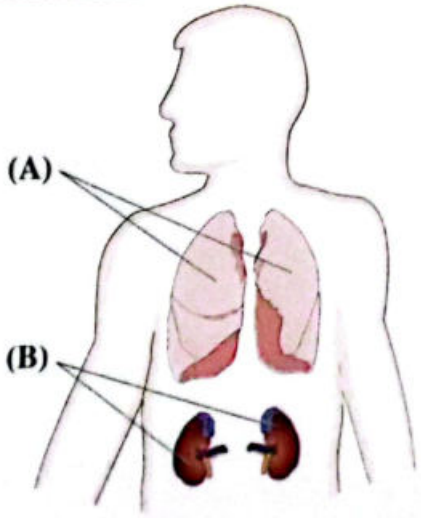
**4** Which of the following **isn't** from the excretory products ?

ⓐ $CO_2$ ⓑ Nitrogen. ⓒ Water. ⓓ Urea.

**5** Which of the following foodstuffs produces the largest amount of uric acid through the breaking down of its digestion products ?

ⓐ Bean. ⓑ Rice. ⓒ Butter. ⓓ Honey.

**6** The opposite figure shows some body organs that participate in the excretion process :




**(1)** Which substance(s) is/are excreted by organ (A) not by organ (B) ?

ⓐ $H_2O$ ⓑ $CO_2$
ⓒ Spices. ⓓ Urea.

**(2)** Which substance(s) is/are excreted by organ (B) not by organ (A) ?

ⓐ $H_2O$ ⓑ $CO_2$
ⓒ Spices. ⓓ Urea.

**7** Which of the following wastes are produced from the catabolism of the products of a piece of bread after its digestion ?

(a) $O_2$ and $CO_2$
(b) Water and $O_2$
(c) Water and $CO_2$
(d) Nitrogen and $CO_2$

**8** Which of the following is/are considered from the harmful metabolic products that are resulted from the digestion of a piece of meat eaten by a person ?

(a) Nitrogen.
(b) Amino acids.
(c) Nitric acid.
(d) Urea.

**9** Which of the following pass through the plasma membranes during the gas exchange process ?

(a) $CO_2$ and $H_2O$
(b) $O_2$ and $N_2$
(c) $N_2$ and $CO_2$
(d) $H_2O$ and $N_2$

**10** Which of the following is from the functions of the human skin epidermis ?

(a) Decreasing the body temperature.
(b) Extracting the nitrogenous wastes from the blood.
(c) The production of sweat.
(d) Preventing the bacterial invasion to the body.

**11** Which of the following structures extend through the epidermal and dermal layers of the skin ?

(a) Hair and blood vessels.
(b) Hair and sweat glands.
(c) Sweat glands and tactile corpuscles.
(d) Sebaceous glands and blood vessels.

**12** When the temperature of the surrounding environment is higher than usual, which of the following represents the response of blood vessels that are located near to the skin surface and sweat glands activity respectively ?

(a) Constrict / Decreases.
(b) Dilate / Decreases.
(c) Constrict / Increases.
(d) Dilate / Increases.

**13** Which of the following cells its absence causes losing the skin its natural colour ?

(a) The cells that are found in the surface layer of the skin epidermis.
(b) The cells that are found at the base of the inner layer of the skin epidermis.
(c) The cells that form the connective tissues in the skin dermis.
(d) The cells that form the layer adhering to the body.

**14** Which of the following **doesn't** happen when the hand is put inside a plastic bag and tied tightly around the hand wrist ?

ⓐ The temperature increases inside the bag.

ⓑ The sweat glands are activated to extract the sweat from the blood.

ⓒ The fat glands are activated in the skin.

ⓓ The sweat remains on the surface of the skin.

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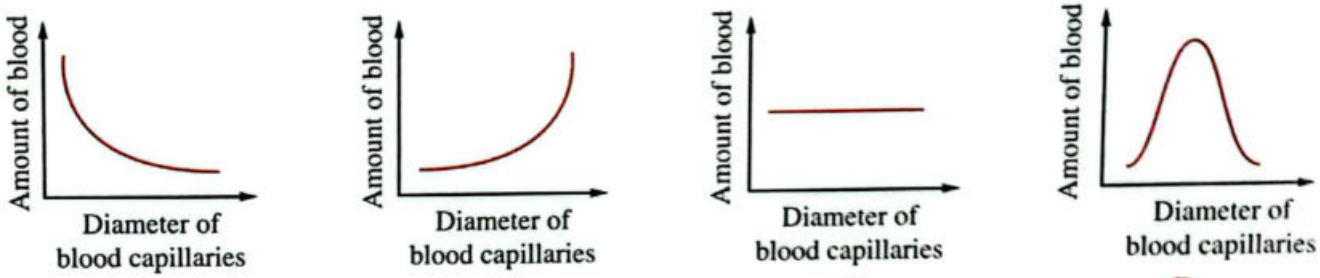
**15** Which of the following graphs represents the blood amount that reaches the sweat glands and the blood capillaries diameter at high atmospheric temperatures ?




ⓐ ⓑ ⓒ ⓓ

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**16** What happens to the rate of sweat secretion in winter ?

ⓐ Stops. ⓑ Increases. ⓒ Decreases. ⓓ Isn't affected.

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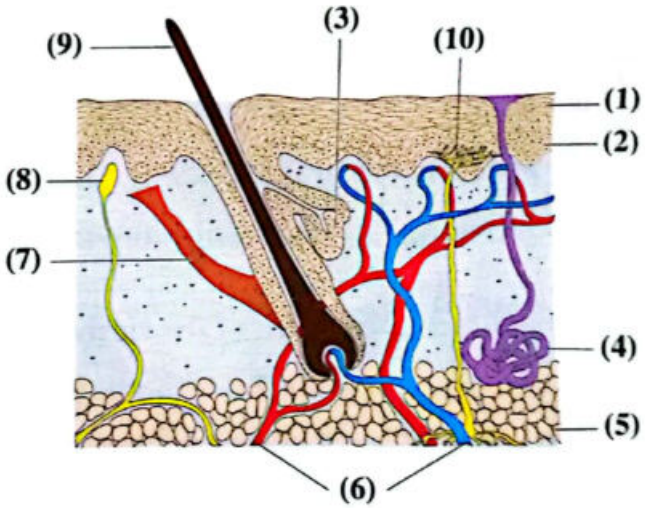
**17** The opposite figure shows a section in the human skin :




- **(1)** Which of the following structures participate in the regulation of the body temperature ?

  ⓐ (3) and (4).

  ⓑ (4) and (6).

  ⓒ (5) and (7).

  ⓓ (6) and (9).

- **(2)** What is the structure that contains melanin secreting cells ?

  ⓐ (1). ⓑ (2). ⓒ (3). ⓓ (5).

- **(3)** Which of the following structures causes hair dryness, when a disturbance takes place in its function ?

  ⓐ (3). ⓑ (4). ⓒ (5). ⓓ (8).

- **(4)** On which of the following structures does the action of structure no. (4) depend ?

  ⓐ (5). ⓑ (6). ⓒ (7). ⓓ (8).

(5) The flexibility and movability are from the properties of structure no. (9), which of the following are responsible for the two properties respectively ?

ⓐ (3) and (7). ⓑ (7) and (3). ⓒ (6) and (7). ⓓ (7) and (6).

(6) Which of the following structures show the function of the skin as a sensory organ ?

ⓐ (1) and (2). ⓑ (3) and (4). ⓒ (7) and (9). ⓓ (8) and (10).

(7) When a change occurs in the surrounding temperature from hot to cold, which of the following do you expect to happen ?

ⓐ The activity of structure no. (3) increases.

ⓑ The activity of structure no. (4) decreases.

ⓒ The structure no. (6) dilates.

ⓓ The structure no. (7) relaxes.

18 Which of the following structures its absence causes the hair hardening and splitting ?

ⓐ The sweat gland that is near to it. ⓑ Melanin substance.

ⓒ The muscle that is responsible for its movement. ⓓ The fat gland that surrounds it.

19 Which of the following organs represent(s) the first line of defense in human against microbes ?

ⓐ Skin. ⓑ Two lungs. ⓒ Two kidneys. ⓓ Liver.

20 What is the reason for the skin ability to keep the body temperature ?

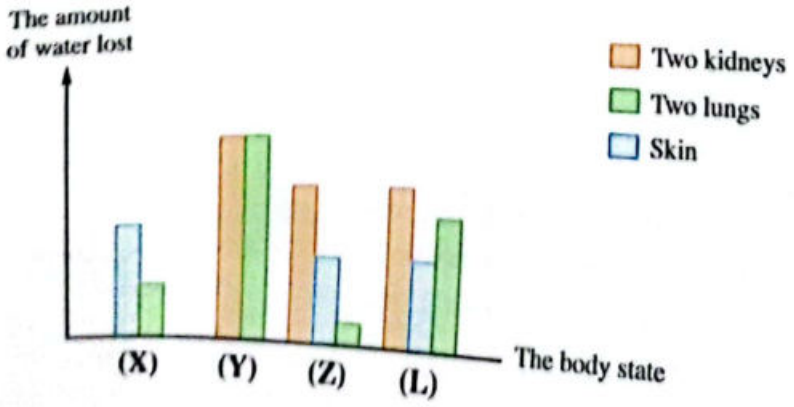
ⓐ Lack of the number of blood capillaries around the sweat glands.

ⓑ Accumulation of wastes on pores.

ⓒ Lack of wastes from the sweat.

ⓓ Exit of water in liquid state, then it evaporates.

21 The following graph represents the amount of water lost from the body in different cases, which choice represents the state of the body within a short-distance running marathon ?




ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (L).

**22** Which of the following happens, if the sweat glands are absent from the skin ?

ⓐ The surface body temperature increases and the skin dryness takes place.
ⓑ The surface body temperature increases and the skin moisture takes place.
ⓒ The surface body temperature decreases and the skin moisture takes place.
ⓓ The surface body temperature decreases and the skin dryness takes place.

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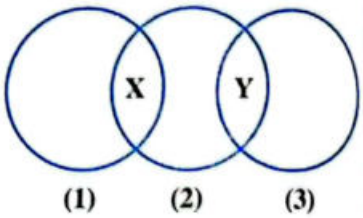
**23** ✳ The opposite figure illustrates three excretory organs in the human body, if you know that organ no. (1) has a role in the digestion process, and organ no. (3) is the largest organ in the body :




**(1)** What does organ no. (2) represent ?

ⓐ Liver. ⓑ Lung. ⓒ Skin. ⓓ Kidney.

**(2)** What do the excretory products (X) and (Y) represent respectively ?

ⓐ Water / Mineral salts.
ⓑ Mineral salts / Water.
ⓒ Poisonous substances / Nitrogenous wastes.
ⓓ Nitrogenous wastes / Poisonous substances.

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**24** ✳ Which of the following **doesn't/don't** participate in the excretion process in the body ?

ⓐ Sweat gland. ⓑ Anus. ⓒ Alveolus. ⓓ Liver cells.

---

**25** ✳ Which of the following the body gets rid of it/them mainly through sweat ?

ⓐ Excess body temperature. ⓑ Excess salts.
ⓒ Excess water. ⓓ Nitrogenous wastes.

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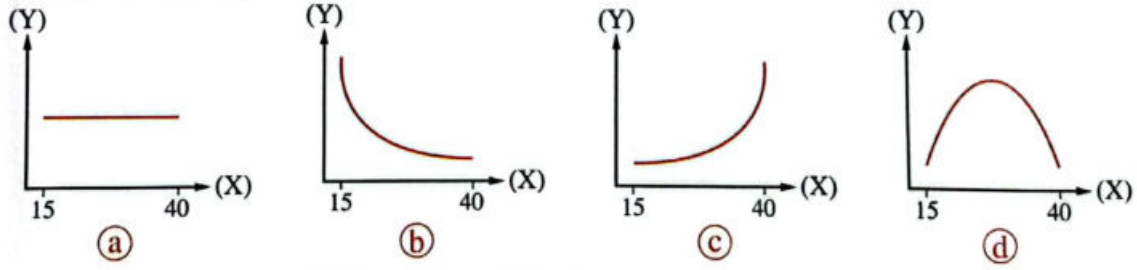
**26** ✳ Which of the following graphs illustrates the relationship between the change in the rate of sweat secretion (Y) and the atmospheric temperature (X) in case of non-performing any physical activity ?

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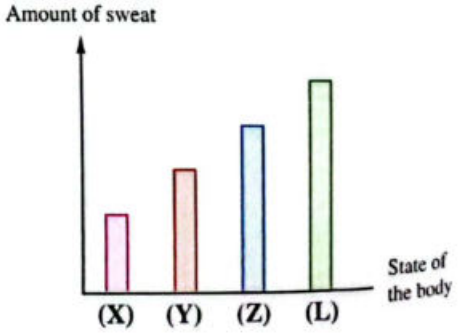
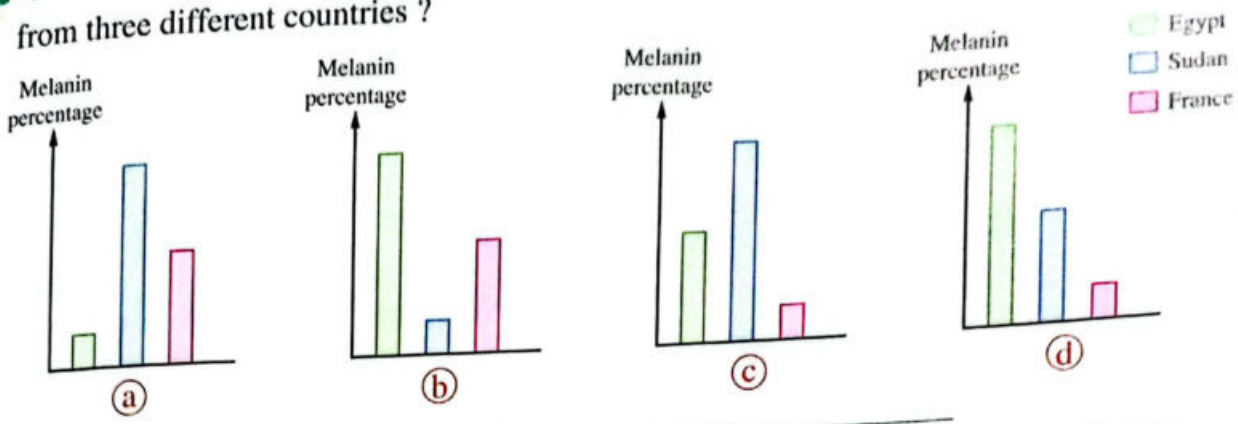
**27** ✳ The opposite graph shows the amount of sweat excreted by the body within four days from the four year seasons. Which choice represents the state of the body just after drinking one liter of water on the daytime of July ?

ⓐ (X). ⓑ (Y).
ⓒ (Z). ⓓ (L).



**28** ✱ Which of the following graphs represents the melanin percentage in three individuals from three different countries ?




**29** ✱ By which are the most sweat-secretory parts in the body characterized according to the sweat glands and blood capillaries respectively ?

ⓐ Less / Less. ⓑ More / More. ⓒ Less / More. ⓓ More / Less.

## Second Miscellaneous Questions

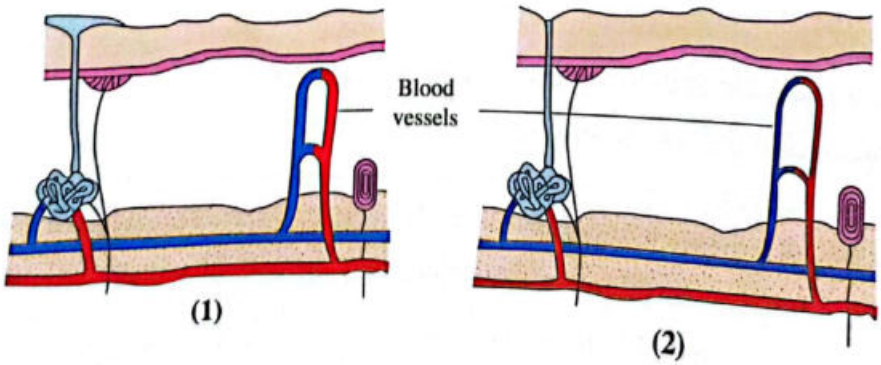
**1** **Compare between :** the excretion process and defecation process in human, "**according to :** the scientific concept".

**2** **What is the role of :** skin in the excretion process in human ?

**3** **Give reason for :** the sweat gland is surrounded by lots of blood capillaries.

**4** **Compare between :** the skin epidermis and dermis in human, "**according to :** the structure".

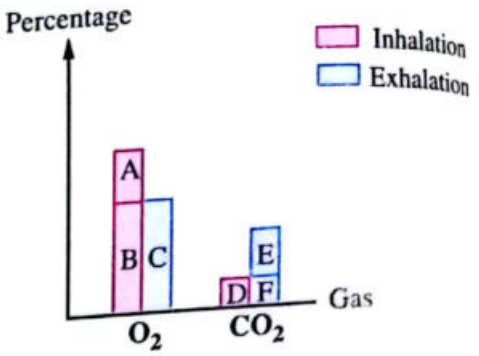
**5** **The two following figures** represent two sections in the human skin, **determine which one** is exposed to hot weather, and **which one** is exposed to cold weather.




**6** **What happens in case of :** the accumulation of dead skin layers on the skin epidermis ?

## Choose the correct answer :

**1** The opposite graph shows the percentage of each of $O_2$ and $CO_2$ gases that enter and exit from the two lungs :




**(1)** Which letter(s) refer(s) to the percentage of the gas(es) that pass(es) through the plasma membranes after its/their entry to the alveoli ?

ⓐ (A) only. ⓑ (B) only. ⓒ (A) and (D). ⓓ (A) and (B).

**(2)** Which letter(s) refer(s) to the percentage of the gas(es) that pass(es) through the plasma membranes before its/their exit from the alveoli ?

ⓐ (C) only. ⓑ (E) only. ⓒ (C) and (E). ⓓ (E) and (F).

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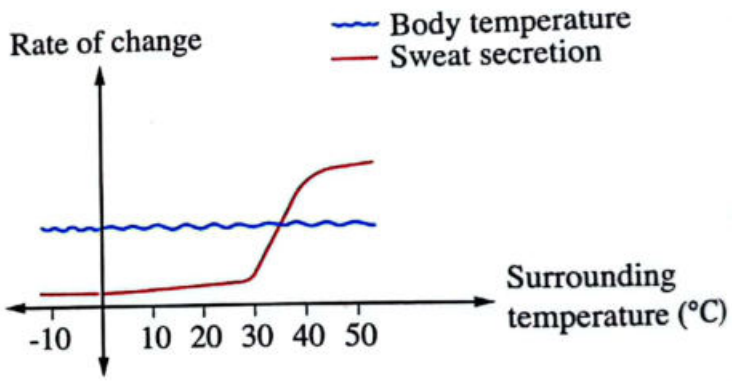
**2** The following graph represents the relation between the surrounding temperature and the rate of change in the body temperature with the sweat secretion in human, which of the following can be concluded from the graph ?




ⓐ Sweat regulates the body temperature, when the surrounding temperature increases above 30°C.

ⓑ The sweat amount plays a role in decreasing the body temperature at all the surrounding temperatures.

ⓒ The body temperature is affected by changing the surrounding temperature.

ⓓ There is an inverse relationship between the body temperature and the sweat amount.

---

**3** A person stayed in a room with temperature 40°C for 30 minutes, what do you expect to happen for the temperature of his body surface and the rate of sweat secretion respectively, when drinking many cups of cold water ?

ⓐ Decreases / Decreases. ⓑ Decreases / Increases.

ⓒ Increases / Decreases. ⓓ Increases / Increases.

**4** Which of the following statements is considered the most accurate about the two layers of skin epidermis ?

(a) The surface layer of skin epidermis affects the inner layer.

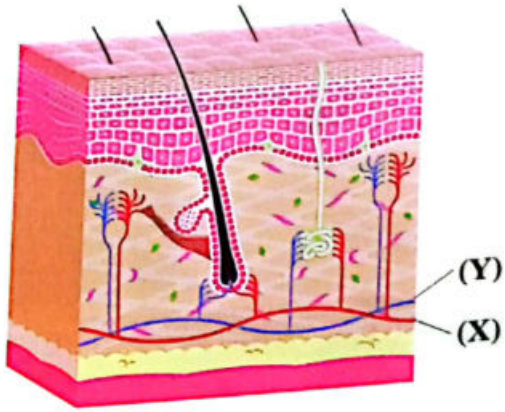
(b) The inner layer of skin epidermis affects the surface layer.

(c) Each layer affects the other.

(d) There is no relation between the two layers.

---

**5** The opposite figure represents a diagrammatic section in the human skin. Study it, then determine, which of the following tables represents the percentage of $CO_2$, salts and nitrogenous wastes in each of (X) and (Y) blood vessels, when the temperature is 40°C ?




| | (X) | (Y) |
|---|---|---|
| $CO_2$ | Lower | Higher |
| Salts | Higher | Lower |
| Nitrogenous wastes | Lower | Higher |

(a)

| | (X) | (Y) |
|---|---|---|
| $CO_2$ | Higher | Lower |
| Salts | Higher | Lower |
| Nitrogenous wastes | Lower | Higher |

(b)

| | (X) | (Y) |
|---|---|---|
| $CO_2$ | Higher | Lower |
| Salts | Lower | Higher |
| Nitrogenous wastes | Higher | Lower |

(c)

| | (X) | (Y) |
|---|---|---|
| $CO_2$ | Lower | Higher |
| Salts | Higher | Lower |
| Nitrogenous wastes | Higher | Lower |

(d)

**Why** do you think urine samples have different colours among individuals ?

Chapter 4

Lesson Two

# Continue : Excretion in Man (Kidney and Liver)

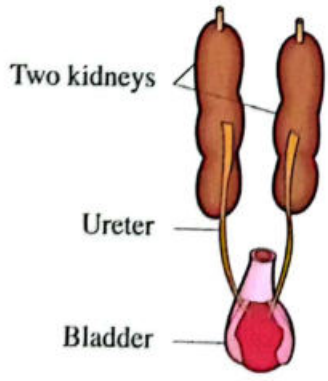
## Second Kidney

- **Each vertebrate has two kidneys that differ in shape and size, according to the degree of its evolution :**

### In lower vertebrates

**(as amphibians)**

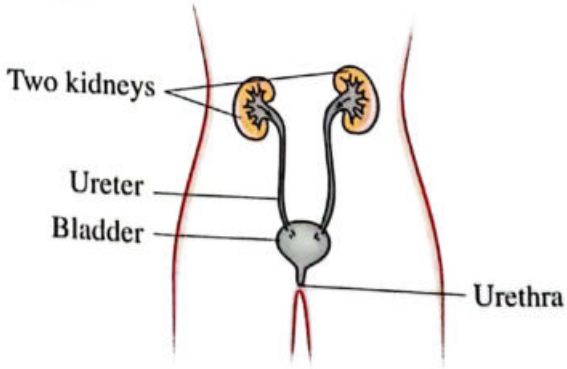
- Kidneys are long thin organs which extend along the two sides of the vertebral column.




### In higher vertebrates

**(as mammals)**

- Kidneys are more compact and situated behind the **peritoneum** (membrane that lines the abdominal cavity).
- A tube called **ureter** runs from each kidney and transfers urine to be collected in the bladder, then urine is passed to outside through the urethra.




### Do you know ... ?

- **Lower vertebrates :** include fish and amphibians.
- **Higher vertebrates :** include reptiles, birds and mammals.

## 1 Test yourself

**Choose the correct answer :**

In which of the following living organisms are the kidneys more compact ?

(a) Frog. (b) Salamander. (c) Bolti fish. (d) Gorilla.

### Kidney in the human body

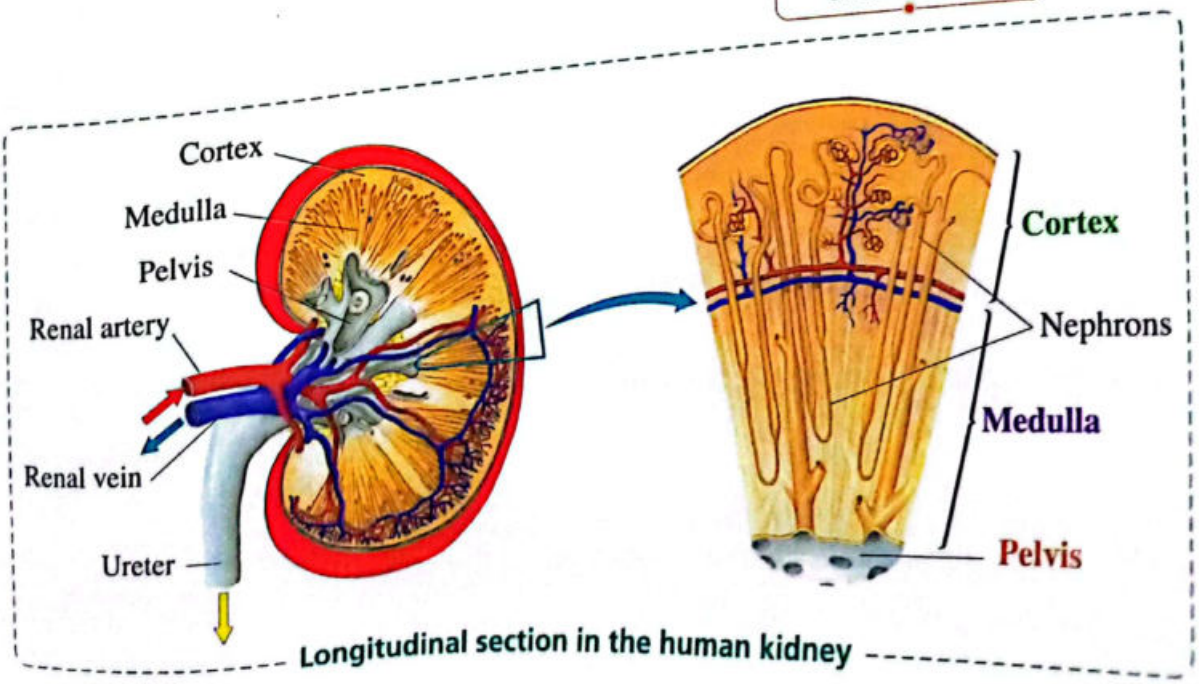
- **Site :**
The two kidneys are situated in the upper part of the abdominal cavity, one at each side of the vertebral column.
- **Size :**
The length of each kidney is about 12 cm long and about 7 cm wide, while its thickness is about 3 cm.
- **Description :**
- The kidney is bean-shaped, where its outer part is convex, while the inner one is concave.
- At the inner concave side (which is called pelvis) of each kidney, the renal artery (coming from the aorta) enters and the renal vein comes out, which is connected to the inferior vena cava, besides the ureter is emerged from it.
- **Structure :**
On examining a longitudinal section of the human kidney, it is observed that it **consists of :**

Two regions

1 **Cortex :** The outer narrow region of the kidney.

2 **Medulla :** The inner broad region of the kidney.

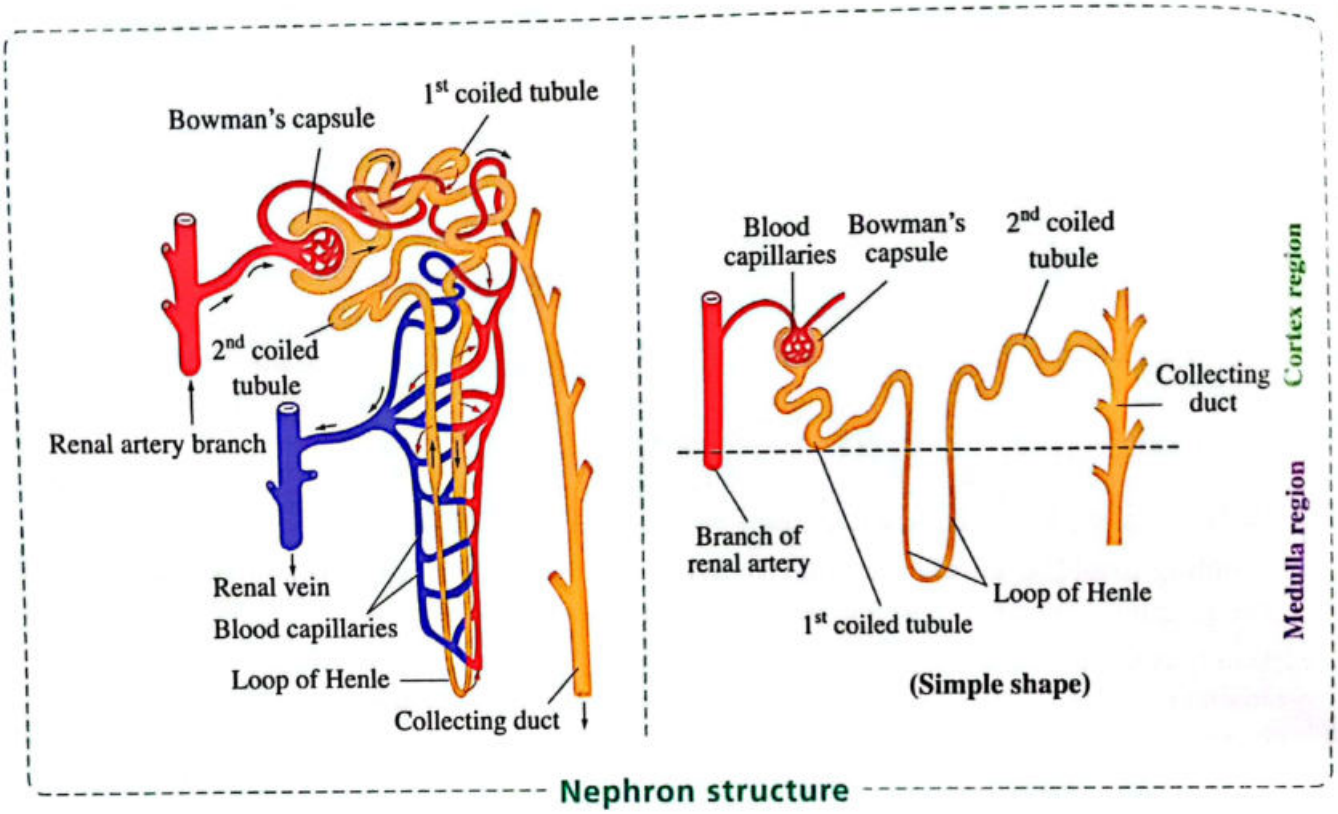
**Pelvis :** Concave cavity of the kidney.




Longitudinal section in the human kidney

## Nephron

- It is the functional unit of kidney.
- Each kidney contains about one million nephrons.

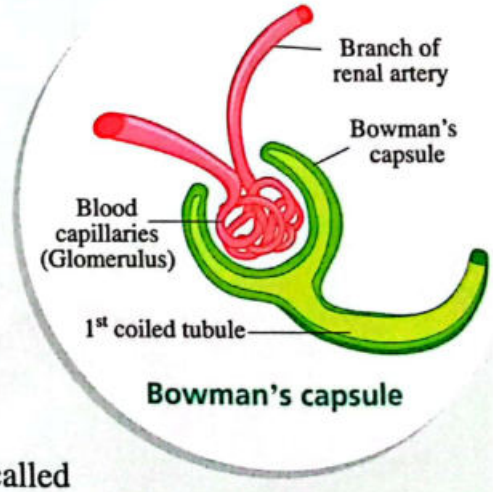



Nephron structure

- It is considered a fine tube **that is differentiated into :**

**- Bowman's capsule :**

- It is the swollen part at the beginning of the nephric tubule and it is cup-shaped, thin and double-walled capsule.
- It is found in the cortex.




**- Nephric tubules :**

- It starts to be coiled in the cortex and called "1st coiled tubule".
- It becomes U-shaped structure in the medulla and called "loop of Henle".
- It returns coiled again in the cortex and called "2nd coiled tubule".

**Note**

The 2nd coiled tubules are gathered in tubes called the collecting ducts that open in the concave cavity of the kidney (**pelvis**).

## 2 Test yourself

**Choose the correct answer :**

Which of the following statements is wrong ?

(a) The nephron is connected with one collecting duct.

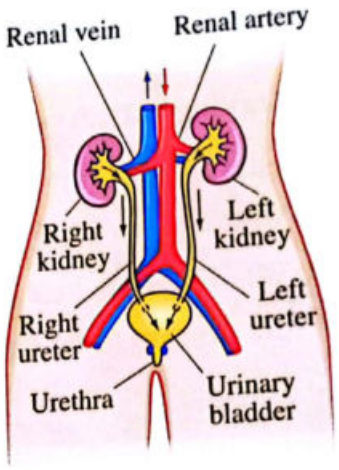
(b) One collecting duct is connected with more than one nephron.

(c) The nephric tubule ends in the kidney pelvis.

(d) The nephron is connected with the collecting duct in the kidney cortex.

## Structure of the urinary system

1. **Two kidneys.**
2. **Two ureters :** they are two tubes that emerge from the two kidneys and pass the urine drop by drop from the two kidneys to the urinary bladder, where they open at the back of the bladder in an inclined position.
3. **The bladder :** it is a small muscular sac and has a sphincter muscle that closes the outlet of the bladder, till urine accumulates inside it, then the bladder contracts and expels the urine out when needed through a duct called urethra.
4. **The urethra :** it is a duct connected to the bladder through which the urine passes to outside the body.




Structure of urinary system in man

Answered

## 3 Test yourself

**What happens in case of :** the occurrence of a disturbance in the sphincter muscle of the urinary bladder ?

.....

.....

## Urine extraction

- Two branches come from aorta (two renal arteries), where each of them enters the kidney at its concave surface.
- The renal artery branches to a great number of much smaller arterioles, forming a network of blood capillaries inside the cup-shaped nephron (**Bowman's capsule**) which is called the "**glomerulus**".

- The urine is extracted through two processes, **which are :**

**1 Filtration process :**

In Bowman's capsule, the blood fluid (plasma) is filtered out of the blood, including water, wastes, mineral salts and glucose to be passed in **the nephric tubules.**

**2 Selective reabsorption process :**

- Inside the nephric tubules, the reabsorption process of the blood plasma contents that had been filtered occurs to return back water, glucose and mineral substances that the body needs into the blood, while leaving wastes only in the form of urine.
- Urine passes through the ureter after coming out form the kidney, then to the bladder where it is stored.
- When the bladder is filled with urine, its muscles contract to force the urine through the urethra to be expelled out of the body.

**Notes**

(1) Blood cells and some protein molecules are not filtered out in Bowman's capsule during the filtration process, due to their large size.

(2) The kidney doesn't expel all the filtered fluid from Bowman's capsule, as the body will lose much of its required water and essential substances, and in this case the individual should drink 170 liters of water daily to compensate this loss.

**Notes**

(1) The human body contains about 5 : 6 liters of blood, where about 1.2 : 1.3 liters of blood pass through the two kidneys per minute. So, the total amount of blood which passes through the both kidneys daily is about 1600 liters (**i.e.** approximately $\frac{1}{4}$ of the total blood volume that is pumped by the heart).

This means that a very high percentage of blood always passes through the kidney.

(2) There are about 3 liters of plasma (from the total blood volume in the body), where each drop of them passes through the kidney to be examined about 560 times per day.

## Key Points

- The body need from glucose requires the reabsorption of all its molecules by active transport.
- The constancy of the water percentage in blood related to the action of the nephric tubules and the blood capillaries surrounding them.
- The first region where the liquid which is called urine passes through is the "collecting duct".

## Composition of urine

- **It consists of :**
  - Excess water.
  - Nitrogenous wastes (urea).
  - Some inorganic salts.
  - Other excess substances, such as small amounts of glucose and vitamins.

### Do you know ... ?

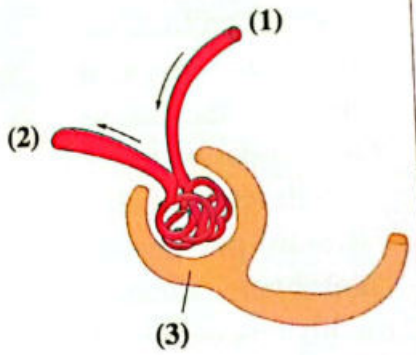
- In normal conditions, kidneys reabsorb all the glucose and return it back into the blood, but when its percentage exceeds **350** milligrams/**100** $cm^3$ in blood (as in the diabetic patients), the **selective reabsorption process fails** and the glucose appears in urine.

## 4 Test yourself

Answered

**1 Choose the correct answer :**

In the opposite figure, which of the following statements is correct about the glucose amount ?




(a) (1) is higher than (2).

(b) (2) is higher than (1).

(c) Equal in both (2) and (3).

(d) (3) is equal to its amount in (1) and (2).

**2 Explain :** the renal vein blood is purer than the renal artery blood.

.....

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## Kidney failure

- The two kidneys stop functioning as a result of their infection with some diseases, which leads to the accumulation of harmful wastes in blood, consequently the occurrence of poisoning, then death.

**Note**

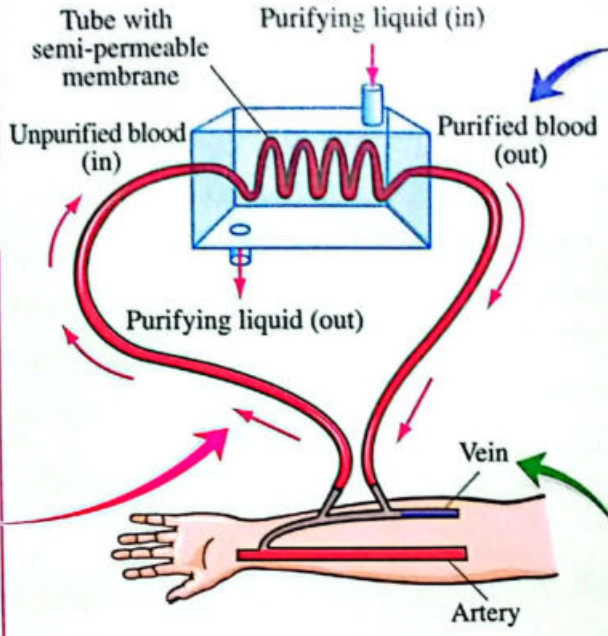
The individual can live with one kidney and in this case, this kidney grows and becomes slightly bigger to perform the function of the two kidneys together, but the individual can't survive for a long time without any kidney, or if his two kidneys stop functioning.

## Artificial Kidney device

- **It is an apparatus that purifies the blood from wastes and it works, as follows :**

**2** From the other side of the membrane, a purifying liquid is passed that contains all the normal plasma contents, **except** urea and other metabolic waste products.

**3** The harmful metabolic wastes are passed from the patient's blood through the semi-permeable membrane to the purifying liquid that is present in the bath of the artificial kidney by diffusion, because the concentration of these wastes is higher in the patient's blood than those that are present in the purifying liquid.




**1** The patient's blood is channelled from the vein connected to an artery to the device, where it passes through a thin tube with a **semi-permeable** membrane (similar to the plasma membrane).

**4** The purified blood is returned to the patient.

**The patient receives the artificial kidney treatment (dialysis) for several times, where each time takes many hours a day and it is required to be performed for 2 - 3 times a week.**

### Do you know ... ?

- Dialysis shunt (Arteriovenous junction) is a long-term junction as the surgeon put it in the dialysis patient's wrist or arm, as he connects an artery with one of the veins, so the vein thickness increases and becomes wider to bear the acupuncture for long times, as the blood flows to it in a high rate with high pressure to let the largest amount of blood pass through the dialysis apparatus.

## 5 Test yourself

Answers

**Choose the correct answer :**

Which of the following statements **doesn't** agree with dialysis ?

(a) The membrane that is present in the dialysis device is semi-permeable.

(b) The concentration of urea in the purifying liquid is equal to its concentration in the blood during dialysis.

(c) The concentration of glucose and minerals in the purifying liquid is equal to their concentration in the patient's blood.

(d) The excess minerals and toxins pass through the membrane in the dialysis device by diffusion.

## Third Liver

- In addition to the function of liver in **digestion** and **metabolism**, liver has an important role in the **excretion** process, **because :**

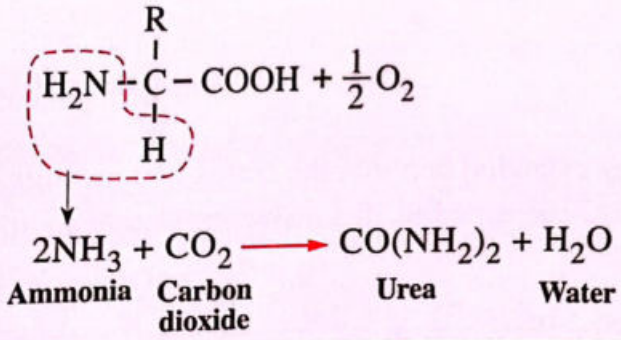
1. It **breaks down** the toxic substances which are absorbed by the small intestine, therefore it participates in purifying the blood from them.
2. It **separates** the nitrogenous amino group ($NH_2$) from the excess amino acids (deamination) and changes it into urea to be expelled through the two kidneys outside the body.

### Urea poisoning

It is the case that is arisen from the accumulation of the excretory substances in the human blood, due to the stop of the two kidneys to perform their function (kidney failure).

### Do you know ... ?

- **The steps of urea formation from the amino acids :**




### 6 Test yourself

Answered

**You have two meals :**

- **The first one :** (Boiled meat – Bread – Vegetables).
- **The second one :** (Pasta – Vegetables – Fruits).

**Recommend the best meal for a patient with kidney failure, and explain your answer.**

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Chapter 4

Questions on Lesson Two

# Continue : Excretion in Man (Kidney and Liver)

Use the App GPS

Interactive toy

The questions signed by ✳ are answered in detail.

Understand · Apply · Analyze

## First Multiple Choice Questions

1 Which of the following is correct about the kidneys ?

(a) Long in rabbits.
(b) More compact in frog.
(c) Extended along the two sides of the vertebral column in salamander.
(d) Located in the lower part of the abdominal cavity in human.

2 The opposite figure illustrates the urinary system of a vertebrate, which living organism has this system ?

(a) Horse.
(b) Monkey.
(c) Frog.
(d) Rabbit.

3 Which of the following extend(s) between the cortex and medulla of the kidney in human ?

(a) 1st coiled tubules.
(b) 2nd coiled tubules.
(c) Loop of Henle.
(d) Collecting ducts.

4 Which of the following **isn't** from the components of the nephric tubule ?

(a) 1st coiled tubule. (b) 2nd coiled tubule. (c) Glomerulus. (d) Loop of Henle.

5 Which of the following is correct about each of the Bowman's capsule and the 2nd coiled tubule ?

(a) Both are located in the medulla.
(b) Both perform the filtration process.
(c) Both are located in the cortex.
(d) Both perform the selective reabsorption process.

6 In which of the following regions are the collecting ducts of nephrons in the two kidneys opened ?

(a) Cortex.
(b) Medulla.
(c) Kidney pelvis.
(d) Cortex and medulla.

**7** Which of the following **isn't(aren't)** filtered when the renal filtrate passes through the nephric tubules ?

ⓐ Glucose. ⓑ Salts. ⓒ Water. ⓓ Some amino acids.

**8** Which of the following structures the blood enters and exits from it as oxygenated blood ?

ⓐ Kidney pelvis. ⓑ Loop of Henle.

ⓒ Kidney medulla. ⓓ Bowman's capsule.

**9** Which of the following passes to Bowman's capsule ?

ⓐ Vitamin C ⓑ Fibrinogen. ⓒ Haemoglobin. ⓓ Thyroxine.

**10** Which of the following represents the amount of proteins in the renal artery to their amount in the renal vein in the healthy person ?

ⓐ Higher than 1 ⓑ Less than 1 ⓒ Equals 1 ⓓ Unidentified.

**11** On examining a urine sample of a person, it shows the presence of a percentage of albumin. What does this result indicate ?

ⓐ The high efficiency of Bowman's capsule.

ⓑ A disturbance in Bowman's capsule function.

ⓒ The shortness of the nephric tubules.

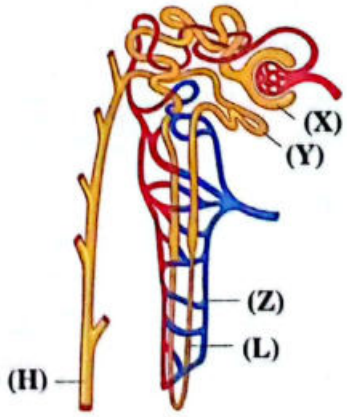
ⓓ A disturbance in the nephric tubules function.

**12** Which of the following nephron parts when a disturbance occurs in its function, this leads to the failure of the filtration process ?

ⓐ Bowman's capsule. ⓑ 1st coiled tubule.

ⓒ 2nd coiled tubule. ⓓ Collecting duct.

**13** In the opposite figure :




(1) At which part is the highest concentration of glucose present ?

ⓐ (Y). ⓑ (Z).

ⓒ (L). ⓓ (H).

(2) Which of the following **isn't** found in part (X) in the normal conditions ?

ⓐ Urea. ⓑ Glucose.

ⓒ Water. ⓓ Haemoglobin.

(3) Which of the following parts contains the highest concentration of salts ?

ⓐ (X). ⓑ (Y). ⓒ (L). ⓓ (H).

(4) Which of the following parts contains a fluid that is equivalent to the blood plasma without some blood proteins ?

ⓐ (X). ⓑ (Y). ⓒ (L). ⓓ (H).

---

**14** Which of the following are related to each other ?

ⓐ The 2nd coiled tubule of the nephron and the concentration of proteins in blood.

ⓑ Bowman's capsule and the glucose level in blood.

ⓒ Eating carbohydrates and the percentage of urea in urine.

ⓓ The nephric tubule and the constancy of water percentage in blood.

---

**15** If you know that the glucose molecules are reabsorbed to the blood, before the renal filtrate reaches the loop of Henle. Which of the following can be concluded about the mitochondria ?

ⓐ They are highly abundant in the cells of the 1st coiled tubule.

ⓑ They are highly abundant in the cells of Bowman's capsule.

ⓒ They are highly abundant in the cells of Bowman's capsule and the 1st coiled tubule.

ⓓ They are not abundant either in the cells of Bowman's capsule or the 1st coiled tubule.

---

**16** The opposite table shows the composition of a fluid in the body of a healthy person : Which structure in the opposite figure contains this liquid ?

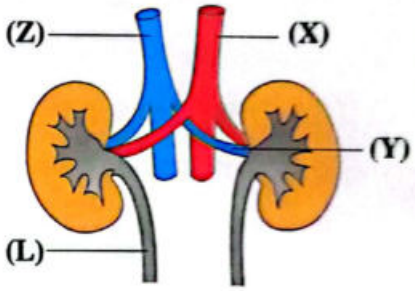
ⓐ (X).

ⓑ (Y).

ⓒ (Z).

ⓓ (L).

| Components | Its(Their) presence |
|---|---|
| Amino acids | ✗ |
| Glucose | ✗ |
| Protein | ✗ |
| Salts | ✓ |
| Urea | ✓ |

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**17** The following table illustrates some components of urine for four people who have the same age and weight in August, which one would you expect that he had eaten a legume-rich meal on the day before the urine sampling ?

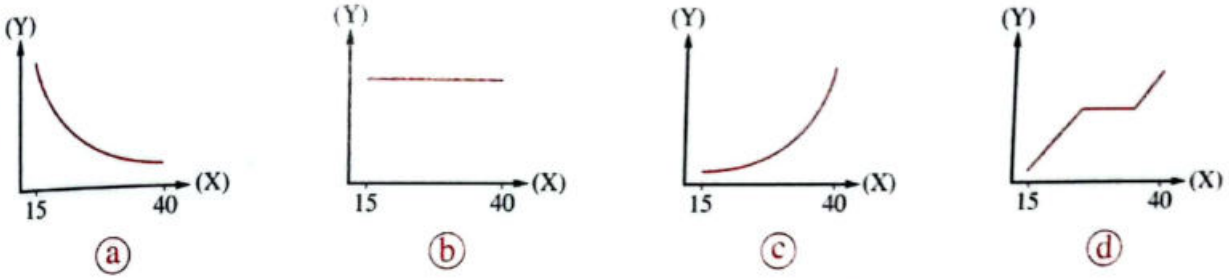
| Person | The percentage of urea in urine | The amount of water in urine |
|---|---|---|
| ⓐ | High | Large |
| ⓑ | High | Small |
| ⓒ | Low | Large |
| ⓓ | Low | Small |

---

**18** The body can get rid of the excess vitamin (C) which is absorbed by the small intestine, which of the following contain(s) vitamin (C) within its/their components ?

ⓐ Bile juice. ⓑ Urine. ⓒ Faeces. ⓓ Exhaled air.

**19** Which of the following graphs illustrates the effect of change in the atmospheric temperature (X) on the rate of urine extraction (Y) for a healthy person, in case of non-performing any physical activity ?




ⓐ ⓑ ⓒ ⓓ

**20** If you know that ADH hormone works on decreasing the amount of water in urine, which of the following may happen when increasing ADH level in blood ?

ⓐ The urea concentration in urine increases.

ⓑ The filtration rate in Bowman's capsule increases.

ⓒ The blood osmolarity increases.

ⓓ The urine osmolarity decreases.

**21** Which choice in the following table refers to an increase in the percentage of water in the urine of a healthy person ?

| | Temperature of the surrounding | The performed activity | Volume of drunk water |
|---|---|---|---|
| ⓐ | Low | Low | Large |
| ⓑ | Low | Excess | Small |
| ⓒ | High | Low | Large |
| ⓓ | High | Excess | Small |

**22** Which of the following represents the amount of blood that is pumped by the heart and passes through the two kidneys during one hour ?

ⓐ About 10 liters. ⓑ About 30 liters.

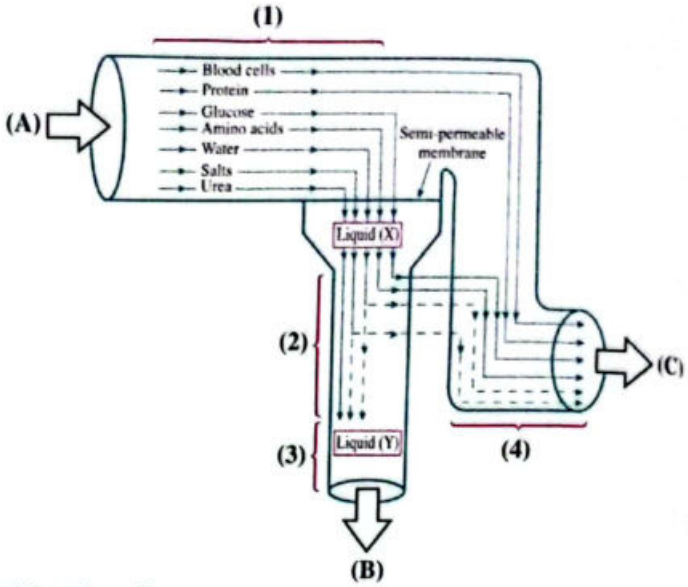
ⓒ About 50 liters. ⓓ About 70 liters.

**23** The abdominal ultrasound images of a patient showed obviously the presence of nephritis, and on examining his urine sample, the absence of blood and protein is observed. Which of the following regions may have inflammations ?

ⓐ Glomerulus. ⓑ Nephric tubules.

ⓒ Glomerulus or nephric tubules. ⓓ Glomerulus and nephric tubules.

**24** Study the opposite diagram which represents the urine extraction process, then answer the following questions :




**(1)** Which of the following is(are) present in structure no. (4) and absent from structure no. (3) ?

ⓐ Blood cells. ⓑ Water.
ⓒ Salts. ⓓ Urea.

**(2)** What is the number that represents the collecting duct ?

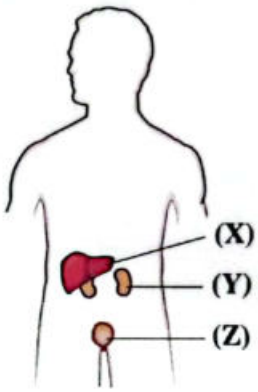
ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).

**(3)** What is(are) the letter(s) that represent(s) urine ?

ⓐ (A). ⓑ (B). ⓒ (C). ⓓ (B) and (C).

---

**25** The opposite figure illustrates some excretory organs in human :




**(1)** Which of the following represents one of the functions of organ (Y) in a healthy person ?

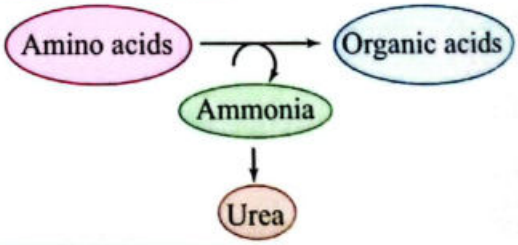
ⓐ Getting rid of the body proteins.
ⓑ Removal of salts completely from the body.
ⓒ Reabsorption of glucose from blood.
ⓓ Regulating the water content in the body.

**(2)** What are the two organs that are responsible for the formation of urea and getting rid of it respectively ?

ⓐ (X) and (Y). ⓑ (Y) and (X). ⓒ (Y) and (Z). ⓓ (Z) and (X).

---

**26** Where does the process illustrated in the opposite figure take place ?




ⓐ Skin. ⓑ Two lungs.
ⓒ Two kidneys. ⓓ Liver.

---

**27** Which of the following illustrates the correct pathway to get rid of urea from the body ?

ⓐ Liver → Kidney → Urethra → Urinary bladder.
ⓑ Liver → Urethra → Kidney → Ureter.
ⓒ Liver → Kidney → Ureter → Urethra.
ⓓ Liver → Ureter → Kidney → Urinary bladder.

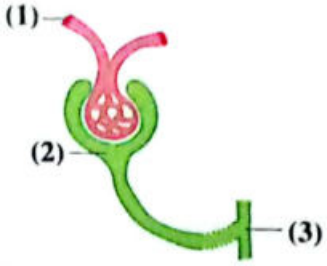
---

**28** Which of the following contain urea with high percentage ?

ⓐ The hepatic vein and hepatic portal vein.
ⓑ The renal and hepatic veins.
ⓒ The renal artery and hepatic vein.
ⓓ The hepatic portal vein and renal artery.

**29** What is the expected result for a person who doesn't drink enough water ?
(a) The osmotic pressure of blood plasma increases.
(b) Plasma filtration stops.
(c) The number of micturition times increases.
(d) The body temperature decreases.

**30** In the opposite figure, what are the fluids found in structures no. (1), (2) and (3) respectively ?
(a) Urine / Renal filtrate / Blood.
(b) Blood / Renal filtrate / Urine.
(c) Renal filtrate / Blood / Urine.
(d) Blood / Urine / Renal filtrate.

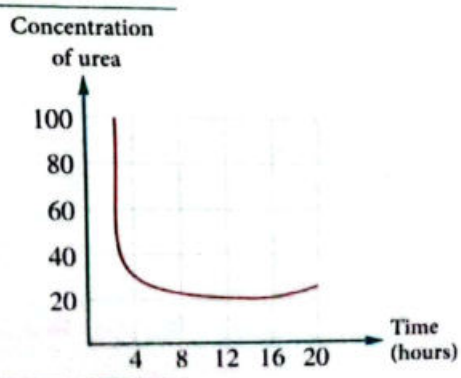



**31** Which of the following statements **disagrees** with the main function of the kidneys in higher vertebrates ?
(a) Getting rid of excess water.
(b) The constancy of water percentage in blood.
(c) Increasing the osmotic pressure in the body.
(d) Getting rid of excess salts.

**32** Which of the following cases forces the doctor to hurry-up with an artificial kidney treatment for a patient ?
(a) The inflammation of the patient's urethra.
(b) The formation of stones in the patient's urinary bladder.
(c) The accumulation of nitrogenous wastes in the patient's blood.
(d) The accumulation of glucose in the patient's blood.

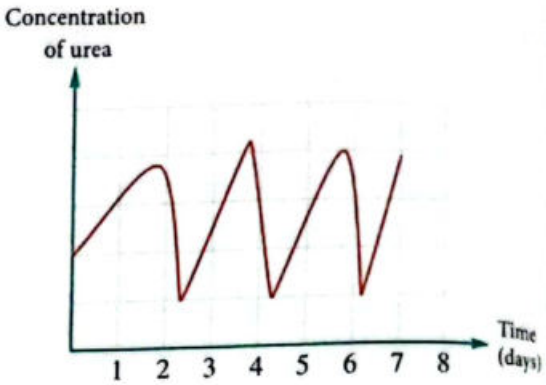
**33** Which of the following foodstuffs may reduce the need for hemodialysis when a kidney failure patient depends on them in his meals ?
(a) Milk derivatives.
(b) Fruits and vegetables.
(c) Grains and legumes.
(d) Meat and poultry.

**34** Study the opposite graph which shows the concentration of urea in the blood of a person, after being extracted from the hepatic vein within a day. Which of the following is applied to this person ?
(a) He suffers from diabetes mellitus.
(b) He suffers from stones in the urinary bladder.
(c) He suffers from hepatomegaly.
(d) He uses the hemodialysis.




**35** Which of the following substances is(are) expected to be found with a higher percentage than normal in the blood sample of a patient suffering from kidney failure ?
(a) Glucose.
(b) Proteins.
(c) Urea.
(d) Salts.

36 The opposite graph represents the concentration of urea in the blood sample of a patient suffering from kidney failure. How many times does this patient undergo the dialysis treatment ?




(a) Twice. (b) Three times.
(c) Four times. (d) Five times.

37 Which of the following foodstuffs **isn't(aren't)** recommended for a kidney failure patient to eat too much ?

(a) Red meat. (b) Brown bread. (c) Olive oil. (d) Vegetables.

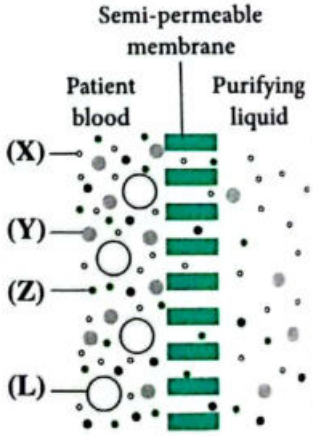
38 Which of the following statements **isn't** applied to urea ?

(a) It is expelled out of the body by the kidneys in the form of urine.
(b) It is formed by the liver through the metabolism of proteins.
(c) It doesn't pass through the plasma membranes of cells.
(d) The kidney failure leads to its accumulation in the blood.

39 Which of the following compounds must be a part of the purifying liquid components in the artificial kidney device ?

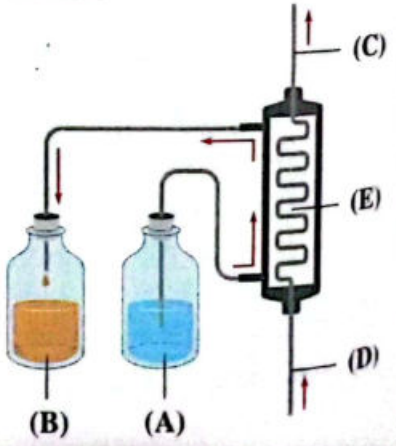
(a) Ammonia. (b) Carbon dioxide. (c) Urea. (d) Glucose.

40 The opposite figure represents the blood purification process by the artificial kidney device, which of the following represents a red blood cell ?




(a) (X).
(b) (Y).
(c) (Z).
(d) (L).

41 The opposite figure shows the mechanism of the artificial kidney device, study it, then determine :



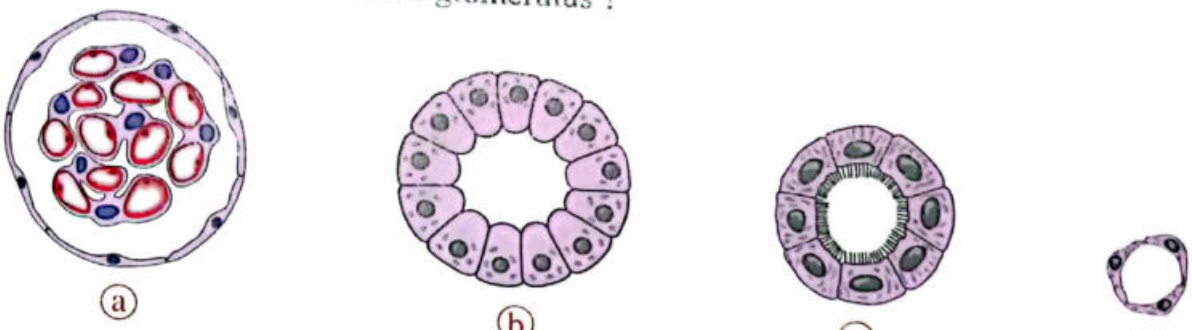

(1) What is the part that contains all the plasma contents **except** urea ?

(a) (A). (b) (B).
(c) (C). (d) (D).

(2) What is the part which contains a fluid that resembles the fluid in the collecting duct of a healthy person ?

ⓐ (A). ⓑ (B). ⓒ (E). ⓓ (D).

42 ✱ The following figures represent T.S. in different parts of the nephron, which one of them represents a section in the glomerulus ?



ⓐ ⓑ ⓒ ⓓ

43 ✱ What is the similarity between Bowman's capsule and the loop of Henle in a healthy person ?

ⓐ The function. ⓑ The location.
ⓒ The percentage of glucose. ⓓ The presence of urea.

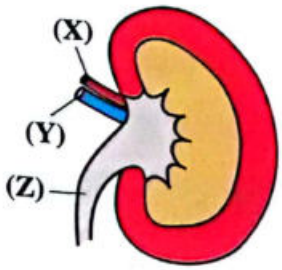
44 ✱ Through which of the following phenomena does the reabsorption of all glucose molecules take place through the nephric tubule in the healthy person ?

ⓐ Osmosis. ⓑ Active transport.
ⓒ Diffusion. ⓓ Selective permeability.

45 ✱ Which of the following the human's kidney **can't** get rid of in normal cases ?

ⓐ Protein. ⓑ Salts. ⓒ Water. ⓓ Urea.

46 The opposite figure illustrates a part of the human urinary system and the blood vessels connected to it :




(1) In the healthy person, which of the following parts transport(s) a high percentage of glucose ?

ⓐ (X) only.
ⓑ (X) and (Y).
ⓒ (Y) only.
ⓓ (X) and (Z).

(2) ✱ Comparing with structure (X) in the figure, which of the following is correct about structure (Y) ?

ⓐ Higher concentration of urea. ⓑ Higher concentration of protein.
ⓒ Lower concentration of urea. ⓓ Lower concentration of protein.

47 ✱ If you know that the concentration of large-sized protein molecules in the blood plasma is 6.5 g/100 $cm^3$. Which of the following expresses their normal concentration in the renal filtrate and urine in the healthy person respectively ?

ⓐ 6.5 / Zero. ⓑ Zero / 6.5 ⓒ 6.5 / 6.5 ⓓ Zero / Zero.

48 ✱ Which choice in the opposite table shows the percentages of some chemical substances that the urine of a healthy person contains ?

| | Percentage in urine (%) | | |
|---|---|---|---|
| | Glucose | Protein | Urea |
| ⓐ | 1 | 4 | 0.03 |
| ⓑ | Zero | 4 | Zero |
| ⓒ | Zero | Zero | 2 |
| ⓓ | 0.1 | 8 | 2 |

49 ✱ Which of the following meals its eating leads to increasing the production of urea ?

ⓐ A meal rich in carbohydrates and poor in fats.

ⓑ A meal poor in carbohydrates and rich in proteins.

ⓒ A meal rich in fats and poor in fibers.

ⓓ A meal poor in fats and rich in fibers.

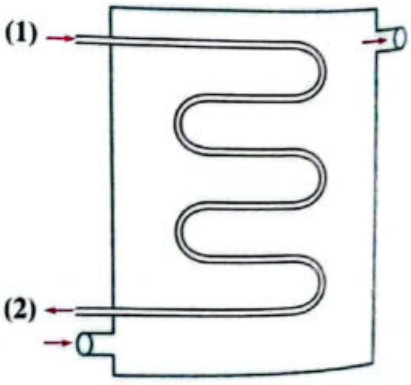
50 ✱ Which of the following human body organs work(s) on balancing the amino acids percentage in the blood plasma ?

ⓐ Two lungs. ⓑ Skin. ⓒ Two kidneys. ⓓ Liver.

51 ✱ Which choice expresses the percentage of nitrogenous wastes in the blood that leaves each of the liver and the two kidneys of a healthy person respectively, after eating a meal rich in proteins ?

ⓐ High / High. ⓑ High / Low. ⓒ Low / High. ⓓ Low / Low.

52 ✱ The opposite figure represents the dialysis device, which of the following statements is correct ?




ⓐ The concentration of urea in (1) is less than its concentration in (2).

ⓑ The concentration of glucose in (1) is less than its concentration in (2).

ⓒ The concentration of urea in (1) is higher than its concentration in (2).

ⓓ The concentration of glucose and urea in (1) is equal to their concentration in (2).

53 ❋ On which of the following phenomena does the purification process of the blood of the kidney failure patient depend ?

(a) Diffusion. (b) Osmosis.

(c) Selective permeability. (d) Active transport.

54 ❋ A disturbance in the artificial kidney device takes place that results in a decrease in the glucose percentage in the purifying liquid. What is the result of examining a blood sample of a patient after using that device ?

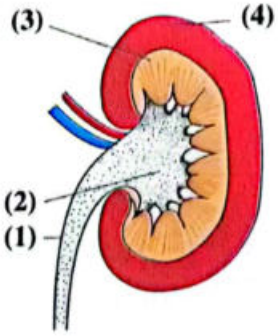
(a) An increase in sodium salts. (b) An increase in glucose level.

(c) A shortage in haemoglobin percentage. (d) A shortage in glucose level.

## Second Miscellaneous Questions

1 **Give reason for :** the collecting duct is named after this name.

2 **From the opposite figure :**




**(a) What** is the function of structure no. (1) ? **And explain how** its contents change after eating a meal of meat.

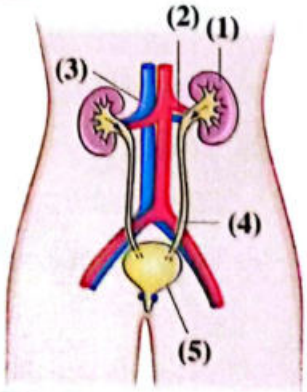
**(b) What** is the functional unit of this figure ? **And in which** part is it found ?

**(c) What is the difference between** structure no. (2) and structure no. (4) ?

**(d)** "One fluid enters this figure and two fluids exit from it", **determine** these fluids.

3 **What happens if :** a man swallows a toxic substance that destroys all the nephrons of his two kidneys ? **Explain your answer.**

4 **In the opposite figure :**




**(a) Mention the name and number of the structure that :**

1. Is located behind the peritoneum membrane.
2. Is branched from the aorta artery.
3. Its contents reach the inferior vena cava.

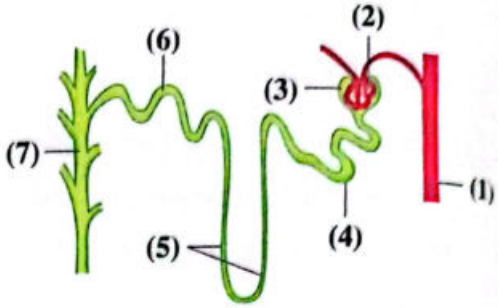
**(b) What** is the function of structure no. (5) ?

5 **Compare between :** the selective reabsorption process and filtration process in the kidney.

6 **What happens in case of :** the exit of all the filtrate of the nephron outside the body ?

**7** **The following figure illustrates the nephron structure :**

- **(a) Mention the number that indicates each of the following :**
  1. The region which contains the highest concentration of water.
  2. The region which contains the highest concentration of urea.



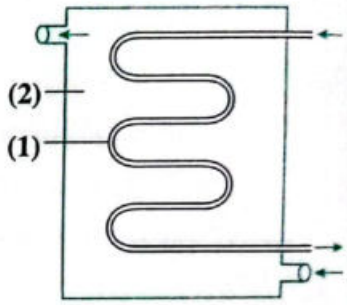

- **(b) What** is the kind of processes that occur in structures no. (3) and no. (6) ?
- **(c) Explain how** the substances pass from structure no. (2) to structure no. (3).
- **(d) Mention** the components that are present in the blood and pass through structure no. (2), and don't pass through structure no. (3). **Explain your answer.**

---

**8** **The opposite figure illustrates the artificial kidney device :**

**(a) What is the difference between** the fluid that passes in no. (1) and the fluid that passes in no. (2) ?

**(b) What** do you expect to happen if fluid no. (2) isn't renewed ?

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**9** **Suggest a reason for :** the appearance of urine sometimes with deep yellow colour and other times with pale yellow colour in normal people.

---

**10** **Give reason for :** the person who donates one of his two kidneys can live with the other kidney.

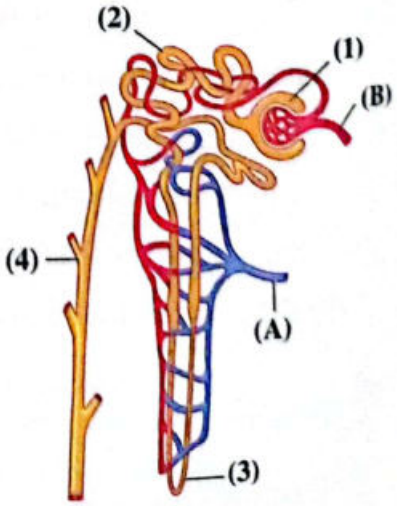
---

**11** **Explain :** the bath of the artificial kidney device contains a specialized purifying liquid.

---

**12** **The opposite figure illustrates the nephron structure :**

- **(a) Where** is structure no. (2) present in the kidney ?
- **(b) Which** one of these parts (A) or (B) carries the blood from the kidney ?
- **(c) What happens** to each of urea and water in structure no. (3) ?
- **(d) What is the difference between** the components of the fluid in structure no. (1) and that in structure no. (4) ?



13 **"The human body forms urea, due to the metabolism of some nutrients" :**

**(a) What** are these nutrients ?

**(b) What** is the organ that forms urea in the human body ? **And what** is the substance from which the urea is formed ?

**(c) What** is the organ that helps the body to get rid of the largest amount of urea ?

14 "A person depends in his nutrition for a long time on meat, eggs and legumes only", **what is the effect of that on his liver ?**

## Questions that measure **high levels of thinking**

Answered in detail

**Choose the correct answer :**

1 If you know that the normal level of glucose in blood is (80 – 120 mg/100 $cm^3$) and its level in the renal artery is (100 mg/100 $cm^3$) and in the renal vein is (70 mg/100 $cm^3$). This indicates the occurrence of a disturbance in some processes, in which of the following structures the disturbance takes place ?

ⓐ Bowman's capsule. ⓑ Nephric tubule. ⓒ Collecting duct. ⓓ Glomerulus.

2 What is the main function of the two kidneys in human ?

ⓐ Getting rid of salts.

ⓑ Getting rid of carbon dioxide and toxins.

ⓒ Adjusting the blood osmolarity and getting rid of toxic substances.

ⓓ Getting rid of excess water.

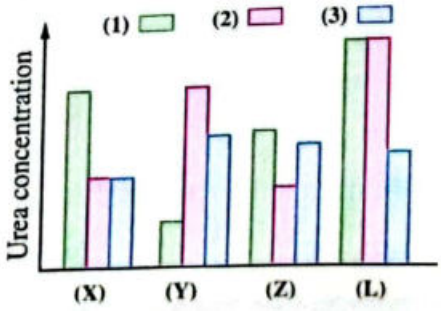
3 Which choice in the following graph represents the urea concentration in the following figure ?

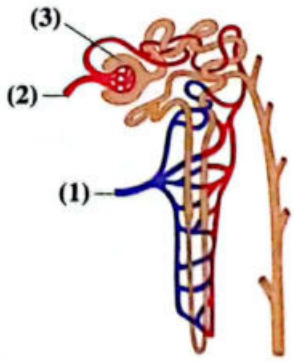
ⓐ (X).

ⓑ (Y).

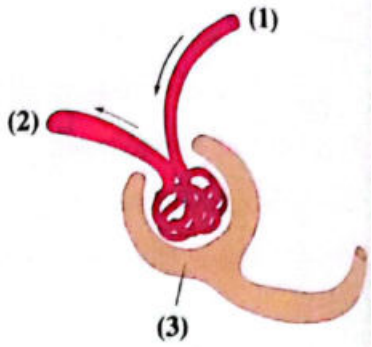
ⓒ (Z).

ⓓ (L).



**4** In the opposite figure, which statement is applied to the large-sized protein molecules ?




ⓐ Their percentage in no. (1) is higher than that in no. (2).

ⓑ Their percentage in no. (2) is higher than that in no. (1).

ⓒ Their percentage is equal in both no. (1) and (2).

ⓓ Their percentage in no. (3) is equal to no. (1) or (2).

---

**5** If you know that the haemoglobin is from the small-sized protein molecules which are present in the red blood corpuscles, if a breakdown of some RBCs occurs. What do you expect to happen during the urine extraction process ?

ⓐ Haemoglobin is not filtered.

ⓑ Haemoglobin is filtered and reabsorbed again.

ⓒ Haemoglobin is filtered and not reabsorbed again.

ⓓ The kidney failure occurs.

---

**6** The following table shows the concentration of some substances during their passage through several parts of the nephron :

| Substance | Concentration ($g/cm^3$) | | | |
|---|---|---|---|---|
| | Region (1) | Region (2) | Region (3) | Region (4) |
| (X) | 0.9 | 0.9 | Zero | Zero |
| (Y) | 82 | Zero | Zero | Zero |
| Salts | 8 | 8 | 9.6 | 16.5 |
| (Z) | 0.2 | 0.2 | 2 | 20 |

**(1)** What are substances (X), (Y) and (Z) respectively ?

ⓐ Glucose, protein and urea.

ⓑ Urea, protein and glucose.

ⓒ Protein, urea and glucose.

ⓓ Protein, glucose and urea.

**(2)** What is the indication of the concentration of the two substances (X) and (Y) in the two regions (1) and (2) ?

ⓐ The occurrence of filtration to (X) and not to (Y).

ⓑ The occurrence of filtration to (Y) and not to (X).

ⓒ The occurrence of reabsorption to (X) and not to (Y).

ⓓ The occurrence of reabsorption to (Y) and not to (X).

(3) What is the indication of the constancy of the concentration of substance (Z) in the two regions (1) and (2) and its increase in region (3) ?

(a) The occurrence of filtration and water reabsorption processes.

(b) The non-occurrence of filtration and water reabsorption processes.

(c) The occurrence of filtration process and non-occurrence of water reabsorption process.

(d) The non-occurrence of filtration process and the occurrence of water reabsorption process.

(4) Which of the following statements agrees with the increase in the concentration of substance (Z) in region (4) ?

(a) The contents of a group of the $2^{nd}$ coiled tubules are collected in it.

(b) No reabsorption of water takes place.

(c) No filtration for substance (Z) takes place.

(d) The reabsorption of substance (Z) in region (3) takes place.

(5) What is the indication of decreasing the concentration of substance (X), till reaching zero in the two regions (3) and (4) ?

(a) The filtration process takes place efficiently.

(b) A disturbance in the filtration process takes place.

(c) The reabsorption process takes place efficiently.

(d) A disturbance in the reabsorption process takes place.

---

7 Which of the following is applied to the blood that comes out from the two kidneys to return back to the body again ?

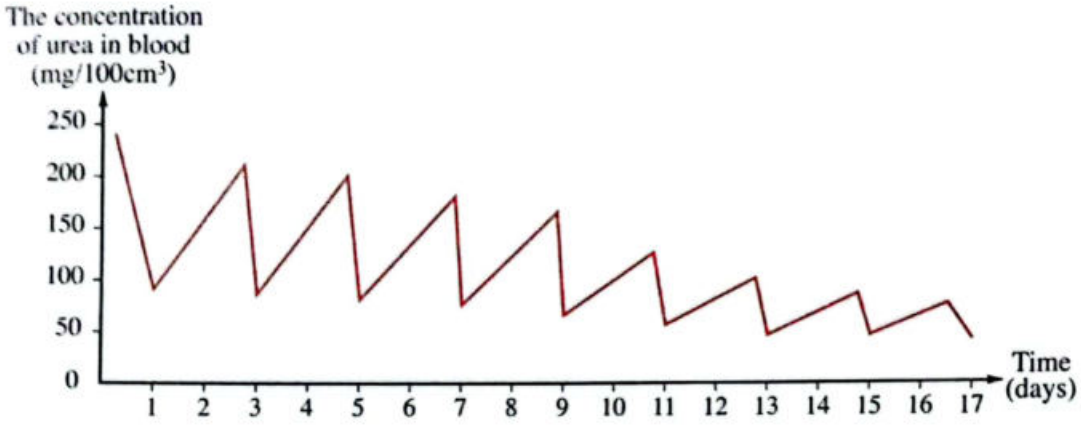
(a) Oxygenated which pours in the superior vena cava.

(b) Deoxygenated which pours in the inferior vena cava.

(c) Oxygenated which pours in the inferior vena cava.

(d) Deoxygenated which pours in the superior vena cava.

8 The following graph illustrates the concentration of urea in the blood of a person during 17 days, if you know that the normal concentration of urea in the blood doesn't exceed 50 milligram/100 $cm^3$ :




**(1)** What is the indication for the curve dropping during 17 days ?

ⓐ The efficiency of the kidneys in adjusting the percentage of urea in blood.

ⓑ Undergoing dialysis.

ⓒ The efficiency of the liver in separating the amino group ($NH_2$).

ⓓ Not eating meals rich in protein.

**(2)** What do you expect to happen for the concentration of urea on the $18^{th}$ day ?

ⓐ It increases again.

ⓑ It decreases and doesn't increase again.

ⓒ It remains constant at 50 milligram/100 $cm^3$.

ⓓ It decreases, then increases again.

## Answer the following question :

**9 "The diabetes mellitus patient suffers from an increase in the glucose level in blood, due to the decrease in insulin hormone secretion" :**

**(a) What happens** to the two kidneys activity of that patient after eating a jam sandwich ?

**(b) Why** does this patient need to drink large amounts of water ?


Chapter 4

Lesson Three

# Excretion in Plant

**There is no specialized excretory system in plants, as the excretion in plants doesn't represent any problem for the plant, due to the following reasons :**

1. The rate of catabolism in plant is much lower than that in animal (if they have the same weight). So, the accumulation of metabolic wastes in the plant cells is very slow.
2. **The green plants** reuse the catabolic wastes, **such as :**
   - Carbon dioxide and water which result from the respiration process are reutilized in photosynthesis process.
   - The nitrogenous wastes are reutilized in the synthesis of the required proteins.
3. **In terrestrial plants**, the metabolic wastes such as organic salts and acids are stored in the plant cells either in the cytoplasm or in the sap vacuoles in the form of insoluble crystals that will not cause any harm to the plant cells.

Note

The wastes that are resulted from carbohydrates metabolism are **less toxic** than the nitrogenous wastes that are resulted from the proteins metabolism.

4. Many plants get rid of $CO_2$ gas and some mineral salts through their roots.
5. Some plants which live in soils that are very rich in calcium can get rid of the excess amounts of this element by its accumulation in the leaves which are finally shed (expelled out).
6. The plant gets rid of $CO_2$ gas which results from respiration and $O_2$ gas that results from photosynthesis process through the leaves stomata by diffusion.
7. The plant gets rid of most of the excess water through transpiration process, and some of it exits through guttation process.

## Test yourself

Answered

**1 Choose the correct answer :**

Which of the following statements agrees with the excretion process of the plant that lives in a soil rich in calcium ?

(a) The falling of leaves indicates that they are full of calcium.

(b) The absence of calcium from the leaves reduces the rate of their fall.

(c) The plant gets rid of the excess calcium by expelling out its leaves.

(d) The plant doesn't need calcium and gets rid of it through leaves.

**2** "The green plant can get rid of all the products of catabolism through excretion process". **How far is this statement correct ? With explanation.**

.....

.....

## First Guttation

### Guttation

It is the excretion of water drops at the leaves tips of some plants in the early morning at the end of spring season (as the stomata are closed at night).

- The guttation drops don't exit through the stomata, but there is a special system for guttation which may consist of one cell or many loose cells, that open by a water stoma called hydathode which is permanently opened day and night.
- The water drops of guttation are characterized by being impure water, since they contain other different substances which may deposit, when guttation water evaporates rapidly.

## Second Transpiration

### Transpiration

It is the process of water loss in the form of water vapour.

Types of transpiration


## 1 Stomatal transpiration

- The process of water loss in the form of water vapour through the stomata.
- The amount of lost water by the stomatal transpiration is more than 90% of the total amount of the lost water by the plant.

**Note**

The whole surface of the plant that is exposed to the atmospheric air loses water through transpiration, but most of the transpired water is lost through leaves, because stomata are abundant in the plant leaves rather than any other vegetative organ.

### ☆ The mechanism of stomatal transpiration :

1. Water passes in the form of vapour from the moist cell walls of the mesophyll tissue in the leaf to the air of the intercellular spaces (air chambers).
2. This water vapour diffuses out to the atmospheric air through the stomata.
3. The same process occurs in the other cells that overlook the other intercellular spaces in the different plant tissues.

## 2 Cuticular transpiration

- The process of water loss in the form of water vapour through the waxy cutin layer (cuticle).
- The amount of lost water doesn't exceed 5% of the total amount of water lost by the plant.

**Cuticle**

It is a waxy cutin layer that covers the epidermis of the vegetative system which are exposed to the atmospheric air.

## 3 Lenticular transpiration

- The process of water loss in the form of water vapour through the lenticels.
- The amount of lost water is very small.

**Lenticels**

They are openings that are present in the cork layer which covers the stems of woody trees.

## Do you know ... ?

- **The factors that lead to increasing the transpiration rate in the plant :**
  - Increasing the surface area of leaves and their number.
  - Increasing the stomata number.
  - Increasing the atmospheric temperature.
  - Decreasing the humidity in the atmosphere.
  - Increasing the light intensity during daytime.
  - Increasing the absorption rate of water.
  - Decreasing air pollution.
  - Increasing wind speed.
  - Decreasing air pressure.

**From the previous, we can conclude that :**

The plant needs great quantities of water that are absorbed from the soil through roots, then they are transferred through the conductive tissues from the root to the stem and leaves. At the same time, the plant loses most of this water in a continuous manner (as mentioned previously).

## 2 Test yourself

Answers

**1 Choose the correct answer :**

**(1)** Which of the following statements **isn't** correct ?

(a) Hydathodes are present in all the plant parts.
(b) Water exits from the hydathodes in the form of water drops.
(c) The leaf stomata open and close.
(d) Water exits from the leaf stomata in the form of vapour.

**(2)** Which of the following **isn't(aren't)** excreted through the stomata of leaves ?

(a) $O_2$ (b) $CO_2$ (c) Pure water. (d) Mineral salts.

**2** "Guttation and transpiration processes occur through the leaf only".
**How far is this statement correct ? With explanation.**

.....
.....
.....
.....

## Importance of transpiration for the plant

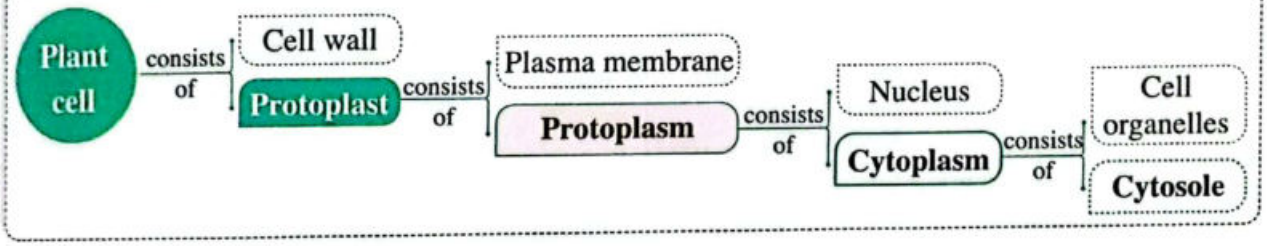
Transpiration process has many functions for the plant, where the most important ones are :

1. **Decreasing the high temperature of the plant**
2. **The ascent of water and salts from the soil**

## 1 Decreasing the high temperature of the plant

- A large amount of energy is absorbed by the plant leaves in the form of heat or converted into heat inside the leaf tissues.
- When the absorbed energy exceeds the plant need for photosynthesis process, it may cause a rise in the leaf temperature, especially in sunny warm days.
- This rise in temperature harms the protoplasm or could lead to its death. So, the transpiration (by the effect of water evaporation) decreases the plant temperature relatively through water loss.

**Remember that**




## 2 The ascent of water and salts from the soil

1. The soil water enters the root cells by osmosis, because the cell sap of root cells has a concentration of solutes (organic and inorganic) higher than the soil solution concentration.
2. Water moves by osmotic pressure from the root hairs to the inner root tissues, till reaching the xylem vessels and tracheids.
3. Water is raised upward in the xylem vessels of stem, then transferred to the vessels of leaves (venules), and at the end it reaches the mesophyll tissue cells, leading to a decrease in their cell sap concentration, therefore the ability of these cells to pull up more water decreases which may stop completely.
4. The water evaporates from the mesophyll cells' walls to the air of intercellular spaces between them which increases the concentration of these cells sap gradually, increasing their ability to pull water upward.

"This explains the transpiration cycle and its role in the ascent of water upward".

**Note**

Osmotic pressure is only enough to move water upward through the plant stem for short distances, according to the root pressure phenomenon. While the adhesion and cohesion theory explains the role of transpiration process in water ascent in the vessels of trees to a height reaching up to 125 meters.

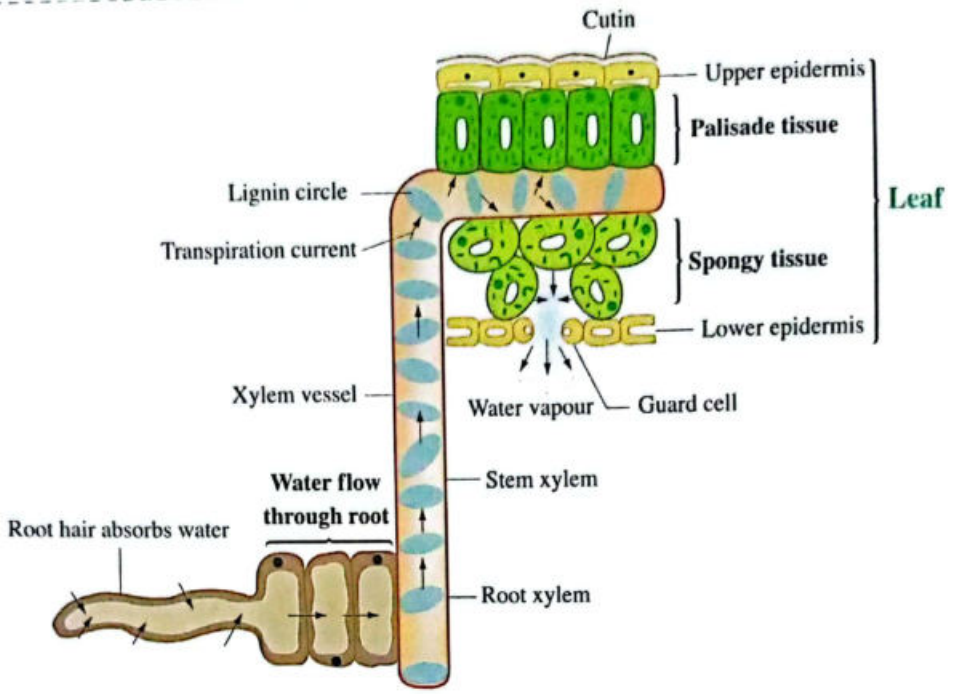



Diagram illustrates the role of transpiration process in the ascent of water

**From the previous, we can compare between guttation and transpiration, as follows:**

| P.O.C. | Guttation | Transpiration |
|---|---|---|
| Definition : | The loss of water in the form of drops at the leaf tips of some plants. | The loss of water in the form of water vapour. |
| Time of its occurrence : | Occurs in early morning at the end of spring season. | Occurs in all seasons of the year and increases in sunny warm days. |
| Location : | The water is lost by a special system which may consist of one cell or many loose cells, that open by a water stoma called hydathode. | The loss of water occurs through stomata, cuticle layer (waxy cutin) and lenticels. |
| Nature of the opening : | The hydathode is permanently opened. | The stomata are opened and closed. |
| Components of the lost water : | The water drops of guttation contain some other different substances which may deposit, if the guttation water evaporates rapidly. | The transpired water doesn't contain any other substances. |
| Amount of the lost water : | Little amount of water drops. | Large amount of transpired water. |

Answered

## 3 Test yourself

**1 Choose the correct answer :**

(1) Which pathway illustrates the transport of water from root to leaves by the action of transpiration force ?

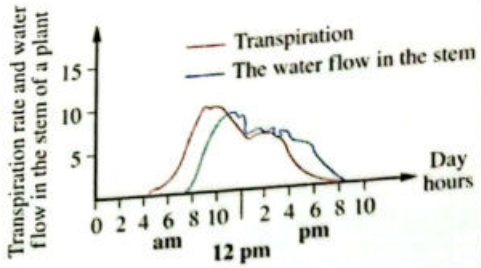
(a) Root hairs ⟶ Xylem vessels ⟶ Root cells ⟶ Mesophyll tissue cells.

(b) Root hairs ⟶ Root cells ⟶ Mesophyll tissue cells ⟶ Xylem vessels.

(c) Root hairs ⟶ Xylem vessels ⟶ Mesophyll tissue cells ⟶ Root cells.

(d) Root hairs ⟶ Root cells ⟶ Xylem vessels ⟶ Mesophyll tissue cells.

(2) What do you conclude from studying the opposite graph ?




(a) The transpiration rate is constant along the day.

(b) There is no relation between the water flow in stem and the transpiration rate.

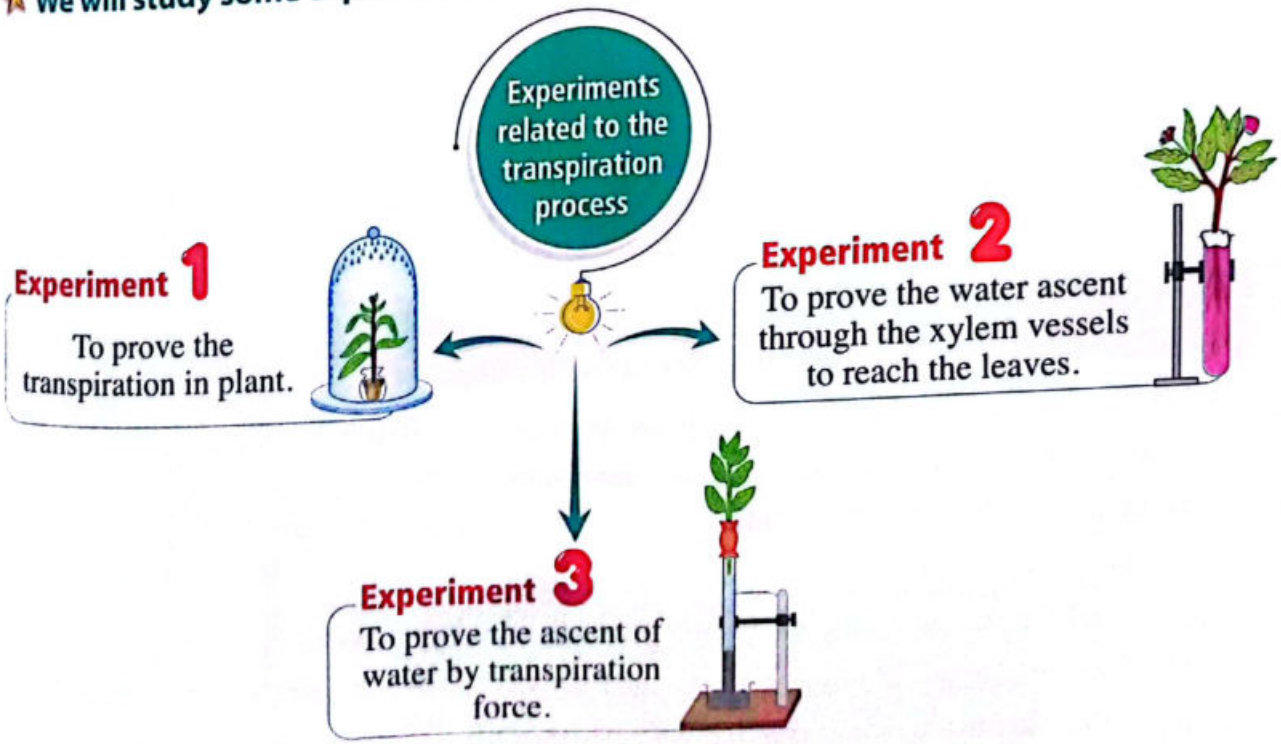
(c) The highest flow of water in stem is more delayed than the highest transpiration rate.

(d) The transpiration rate can't reach zero.

**2 What is the relation between :** the transpiration rate and atmospheric temperature ?

.....

**We will study some experiments related to the transpiration process, as follows :**



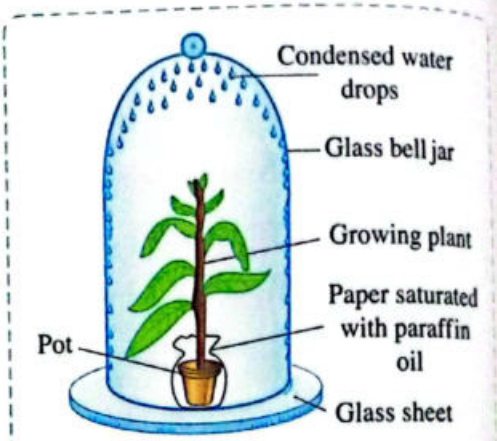
## Practical activity 1 An experiment to prove the transpiration in plant

### Procedure :

(1) Take a potted leafy plant, then cover the soil surface and the surface of the pot that is exposed to air with a paper saturated with paraffin oil.

(2) Place the potted plant on a glass sheet, then cover it with a dry glass bell jar.

(3) Wait for a while.



Transpiration in green plant

### Observations :

(1) Tiny droplets of water appear on the inner surface of the glass bell jar.

(2) These droplets accumulate and become bigger drops, therefore they run downwards on the inner wall of the bell jar.

### Conclusion :

- The green plant performs transpiration process, where the water vapour passes from the exposed parts of plant to air to the surrounding air (inside the bell jar) and some of it may condense in the form of drops.
- If you add the condensed liquid to white anhydrous copper sulphate, it turns into blue, confirming that the condensed liquid is water.

### Do you know ... ?

- The pot that exposed to air is covered by papers saturated with paraffin oil to prevent the evaporation of water from the soil.

## Practical activity 2 An experiment to prove the water ascent through the xylem vessels to reach the leave

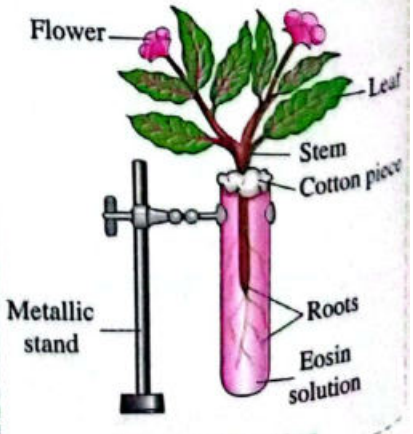
### Procedure :

(1) Fill a test tube with eosin solution that has pink colour.

(2) Carefully detach a small flowering plant (potted plant) with its roots, then immerse the plant roots in the eosin solution in a test tube.

(3) As shown in the opposite figure, close the opening of the tube by using a cotton wool plug around the plant stem.

(4) Keep the tube in a vertical position for several hours.



Ascent of water through xylem vessels

**Observation :**

The leaf petioles' colour is changed into pink (eosin's colour), as well as the veins of leaves and petals.

(5) Cut a thin transverse section in the plant stem, then put it on a glass slide and examine it under the microscope.

**Observation :**

Xylem tissue only is stained by eosin, and this appears through the examination of the transverse section of stem under the microscope.

**Conclusion :**

- Water is absorbed by roots.
- Water ascends upward through xylem tissue of the stem to leaves.

## Practical activity 3 An experiment to prove the ascent of water by transpiration force :

**Procedure :**

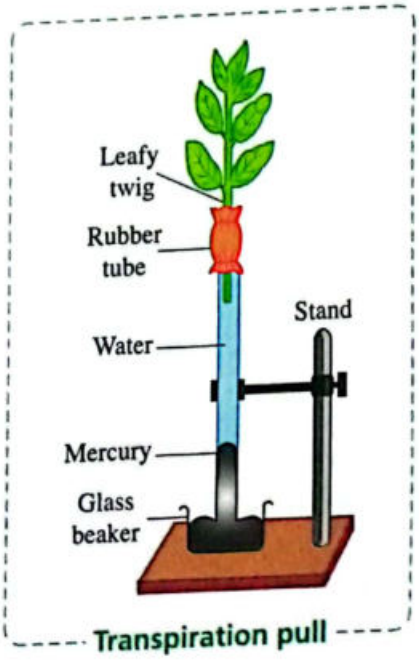
(1) Fill a narrow tube having two opened ends with water and immerse its lower end in a beaker containing mercury.

(2) Cut a leafy twig of a potted plant, where the cutting occurs under the water surface.

(3) Insert the lower tip of the twig in a cork plug through a hole.

(4) Fix the cork plug tightly with the twig in the upper opening of the tube and close it firmly with vaseline or a piece of cloth that is saturated with oil, around the plug at the point of its connection with the tube.

(5) Mark the mercury level in the tube and leave the apparatus in the open air for a while.



Transpiration pull

**Observation :**

Mercury level rises in the tube at the end of the experiment over its original level before starting the experiment.

**Note**

Using the leafy twig is to prove that the root pressure has no effect on the ascent of water.

**Explanation :**

The plant loses water by transpiration. So, it absorbs water from the tube to compensate the water lost through transpiration. As a result, the mercury level rises up in the tube.

**Conclusion :**

The water loss by transpiration generates a pull to raise water upward.

**Remember that**

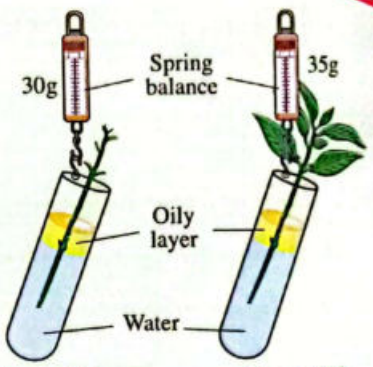
The plant leafy twig is cut under the water surface to avoid the entry of air bubbles inside the twig xylem vessels. So, the water column isn't cut and the pull forces that are resulted from transpiration will not be affected.

## 4 Test yourself

Answer

**Choose the correct answer :**

The opposite figure represents an experiment to measure the rate of transpiration in the two branches of a plant stem, which of the following represents the expected reading of the spring balance after 3 days from the beginning of the experiment ?




| | Plant (1) | Plant (2) |
|---|---|---|
| (a) | 30 g | 35 g |
| (b) | 25 g | 35 g |
| (c) | 29 g | 30 g |
| (d) | 25 g | 30 g |

Chapter 4

Questions on Lesson Three

# Excretion in Plant

Use the App GPS

The questions signed by ✳ are answered in detail. Understand Apply Analyze

Interactive test

## First Multiple Choice Questions

1 Through which of the following processes the plant gets rid of the excess water ?
(a) Catabolism. (b) Guttation. (c) Exudation. (d) Respiration.

2 Which of the following is correct about excretion in plant ?
(a) Plants get rid of salts by expelling them out through leaves and roots.
(b) Plants have no ability to reuse the metabolic wastes.
(c) Some plants can get rid of insoluble salts by storing them.
(d) The carbohydrates metabolic wastes are more toxic than proteins metabolic wastes.

3 If you know that *Elodea* plant is an immersed aquatic plant which lives in fresh water, which of the following do you expect to be **disagreed** with the excretion process in this plant ?
(a) The plant reuses the resulted $CO_2$ from the respiration in the photosynthesis process.
(b) The plant reuses the resulted $O_2$ from the photosynthesis process in the respiration process.
(c) The plant reuses the nitrogenous wastes in the synthesis of protein.
(d) The plant stores salts and organic acids in its cells.

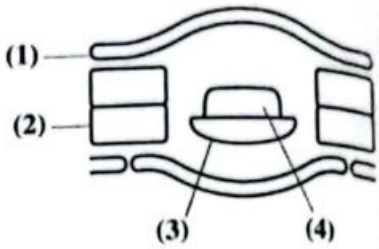
4 What is the factor that helps in expelling out $CO_2$ gas from the stomata of the plant leaves ?
(a) The difference in its concentration inside the leaves from that in the atmospheric air.
(b) Decreasing the catabolic rate of carbohydrates.
(c) Its transfer abundantly from the phloem to the mesophyll tissue.
(d) Increasing the rate of photosynthesis process.

5 Which of the following **isn't(aren't)** considered from the excretory products of the plant ?
(a) Oxygen. (b) Water. (c) Carbon dioxide. (d) Amino acids.

6 Which of the following plant parts play(s) the greatest role in getting rid of the different metabolic wastes produced by the plant ?
(a) Cork cells in the stem. (b) Root hairs.
(c) Plant leaves. (d) Root xylem.

7 What is the importance of guttation for plants ?
(a) Getting rid of $CO_2$ (b) Participating in photosynthesis process.
(c) Getting rid of water and salts through xylem vessels.
(d) Getting rid of organic and inorganic substances.

**8** Study the opposite diagram that represents a T.S. in a leaf of a dicotyledonous plant, then determine :




**(1)** What is the number that refers to the tissues that are responsible for decreasing the leaf temperature ?

ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).

**(2)** What is the number that refers to the tissues that are responsible for rising the water column inside the xylem vessels ?

ⓐ (1). ⓑ (2). ⓒ (3). ⓓ (4).

---

**9** Which of the following represents a similarity between the lost water from each of the lenticular transpiration and stomatal transpiration ?

ⓐ Its location.
ⓑ The presence of additional substances with it.
ⓒ Its nature. ⓓ Its amount.

---

**10** Which of the following contain the least content of water inside the plant ?

ⓐ Xylem vessels in roots. ⓑ Xylem vessels in stem.
ⓒ The air chambers in the leaf. ⓓ The inner walls of leaf cells.

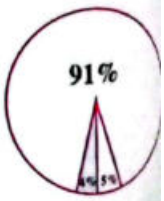
---

**11** If you know that the shade plants are characterized by having a thin waxy layer on the walls of the leaf epidermis cells, what is the result of this fact ?

ⓐ The rate of cuticular transpiration increases. ⓑ The rate of lenticular transpiration increases.
ⓒ The rate of photosynthesis decreases. ⓓ The guttation rate decreases.

---

**12** The opposite figure represents the percentages of water exit from a plant by transpiration, which of the plant parts is represented by the blue area ?

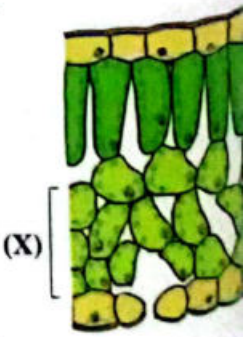



ⓐ Lower epidermis of the leaf. ⓑ Woody stem.
ⓒ Upper epidermis of the leaf. ⓓ Green stem.

---

**13** Which of the following **isn't** from the functions of structure (X) ?

ⓐ Getting rid of salts.
ⓑ Gas exchange.
ⓒ Decreasing the plant temperature.
ⓓ Losing water.

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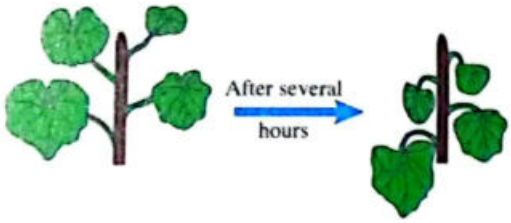
**14** Which of the following structures act as sites for gas exchange in the woody stems ?

ⓐ Stomata. ⓑ Hydathodes. ⓒ Lenticels. ⓓ Roots.

**15** The following figure illustrates a plant stem before and after several hours, which of the following environmental conditions can cause the change that is illustrated in the figure ?




(a) Decreasing the soil water.
(b) Decreasing the light intensity.
(c) Increasing the atmospheric humidity.
(d) Decreasing water and light together.

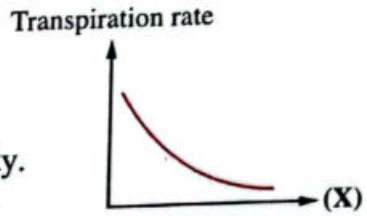
**16** Which of the following is correct about the plant ?
(a) The more increase in the absorbed energy, the more decrease in the transpiration rate.
(b) The plant doesn't control the stomatal transpiration.
(c) The more increase in the transpiration rate, the more increase in the absorption rate.
(d) Lenticular transpiration characterizes all types of plants.

**17** What is the result of planting tomato in a high moist soil ?
(a) Decreasing the rate of guttation.
(b) Increasing the rate of transpiration.
(c) Increasing the rate of nitrogenous wastes excretion.
(d) Decreasing the rate of photosynthesis.

**18** What is the result of decreasing the number of leaves in some desert plants ?
(a) The rate of photosynthesis increases.
(b) The lenticular transpiration decreases.
(c) The stomatal transpiration decreases.
(d) The pulling up of water increases.

**19** Which of the following **can't** cause an increase in the plant transpiration rate ?
(a) Increasing the light intensity.
(b) The opening of stomata.
(c) Increasing the temperature.
(d) Increasing the atmospheric humidity.

**20** The opposite graph shows factor (X) that affects the rate of transpiration, what do you expect this factor to be ?

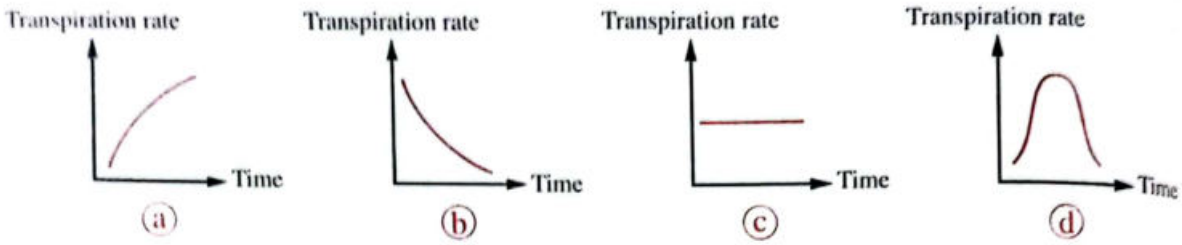



(a) Atmospheric humidity.
(b) Light intensity.
(c) Lack of oxygen.
(d) Temperature.

**21** Which of the following decreases the transpiration rate in green plants ?
(a) Decreasing the light intensity.
(b) Deacreasing the humidity.
(c) Increasing the temperature.
(d) Increasing the stomata number.

**22** Which of the following choices illustrates the change in the transpiration rate, on decreasing the atmospheric temperature and increasing the light intensity respectively ?
(a) Low / Low.
(b) Low / High.
(c) High / Low.
(d) High / High.

23 Which of the following graphs illustrates the rate of transpiration of a plant along the whole day ?




(a) (b) (c) (d)

24 Which of the following plants has the highest rate of transpiration ?

(a) Submerged plant in water.
(b) Floating plant on water surface.
(c) Desert plant.
(d) Shade plant.

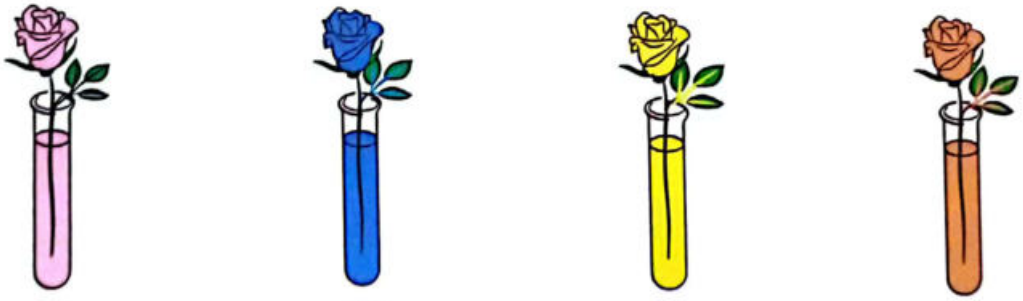
25 Which of the following occurs for the plant when the photosynthesis rate of leaves increases ?

(a) The transpiration rate isn't affected.
(b) The closure of stomata takes place.
(c) The transpiration rate decreases.
(d) The opening of stomata takes place.

26 The leaves of desert wormwood plant are characterized by being reduced, what is the importance of that ?

(a) Reducing the water loss.
(b) Increasing the respiration process.
(c) Increasing the photosynthesis process.
(d) Reducing water absorption.

27 If four leafy plants carrying white flowers are put inside four tubes containing coloured solutions for two days at the same environmental conditions, as illustrated in the following figures. In which tube the leaves were covered by paraffin oil ?



(a) (b) (c) (d)

28 The following table illustrates the rate of water absorption and the rate of transpiration for a plant during the morning :

| Time | 9 am | 10 am | 11 am | 12 pm |
|---|---|---|---|---|
| The rate of water absorption ($cm^3$/ hour) | 15 | 16 | 16 | 17 |
| The rate of transpiration ($cm^3$/ hour) | 7 | 12 | 16 | 21 |

At which time does the wilting of plant leaves appear ?

(a) 9 am.
(b) 10 am.
(c) 11 am.
(d) 12 pm.

29 What happens when transporting a growing plant from a dark place to a warm sunny place ?

ⓐ The photosynthesis rate increases and the transpiration rate decreases.

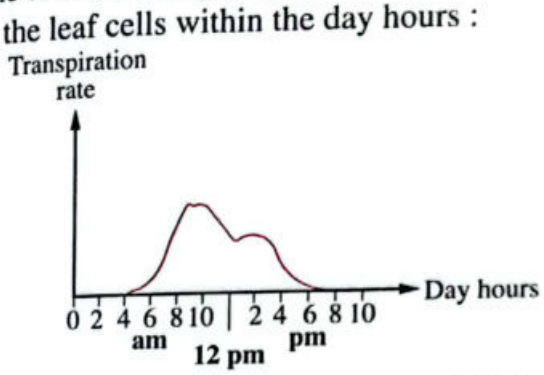
ⓑ The photosynthesis rate decreases and the transpiration rate increases.

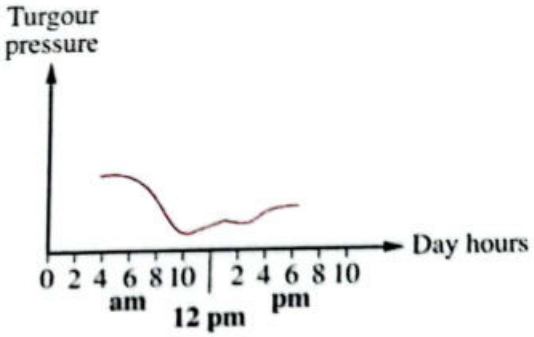
ⓒ The rates of photosynthesis and transpiration decrease.

ⓓ The rates of photosynthesis and transpiration increase.

---

30 The two following graphs illustrate the rate of transpiration and turgour (fullness) pressure in the leaf cells within the day hours :




Which of the following can be concluded ?

ⓐ The increase in the transpiration process leads to decreasing the turgour pressure.

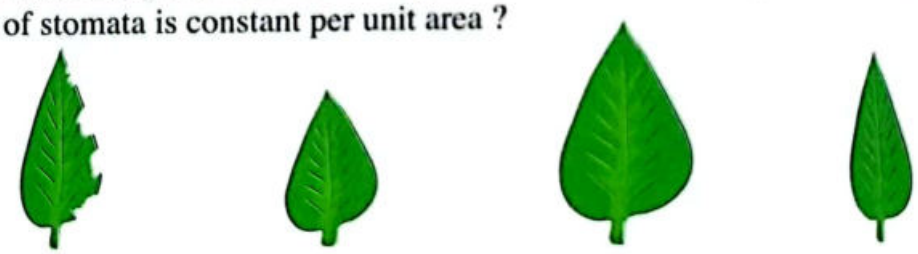
ⓑ The increase in the transpiration rate leads to increasing the turgour pressure.

ⓒ The leaf stomata close at 10 am.

ⓓ The leaf stomata open at 4 am.

---

31 Which of the following leaves loses the highest amount of water by assuming that the number of stomata is constant per unit area ?



ⓐ ⓑ ⓒ ⓓ

---

32 Which of the following statements its occurrence **can't** be applied with the absence of the air chambers from the leaves of bean plant ?

ⓐ The stomatal transpiration stops in the plant.

ⓑ Increasing the plant temperature which harms the protoplast.

ⓒ The ascent of water and salts to the leaves stops.

ⓓ The cuticular transpiration in the plant stops.

---

33 When dipping a growing plant that is exposed to light in paraffin oil, what will happen to the stomatal transpiration ?

ⓐ Decreases. ⓑ Increases. ⓒ Not be affected. ⓓ Vanishes.

---

34 When does the transpiration rate increase in the plant during the day ?

ⓐ In the morning. ⓑ At noon. ⓒ In the evening. ⓓ At night.

35 Which of the following substances the plant gets rid of it(them) abundantly during daytime ?

(a) $CO_2$ (b) Nitrogenous wastes.

(c) Mineral salts. (d) $H_2O$

36 If you have two equal amounts of water, one of them resulted from the transpiration process and the other resulted from the guttation process, how can you differentiate between them ?

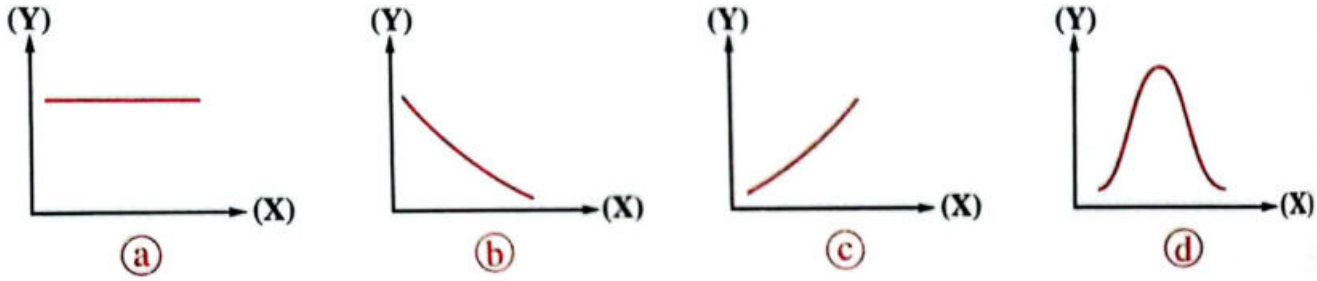
(a) By using white anhydrous copper sulphate.

(b) By using eosin solution.

(c) Through the precipitate that is resulted from the evaporation.

(d) Through the water that is produced from the condensation.

37 Which of the following graphs expresses the relation between the number of leaves (X) and the stomatal transpiration rate (Y) in a plant ?




(a) (b) (c) (d)

38 Which of the following statements **isn't** applied to the excretion process in plant ?

(a) Cuticle layer that covers the epidermis doesn't prevent the transpiration.

(b) The rate of excretion isn't related to the rate of catabolism.

(c) Hydathodes are permanently opened all over the year.

(d) The leaf stomata open and close during the day.

39 Which of the following characterizes the guttation water from the transpiration water ?

(a) It is free from any substance. (b) It exits with large amounts.

(c) It exits from the stomata in the form of vapour.

(d) The plant doesn't control its exit.

40 Which of the following represents a similarity between the guttation and transpiration processes ?

(a) Products. (b) Time of occurrence.

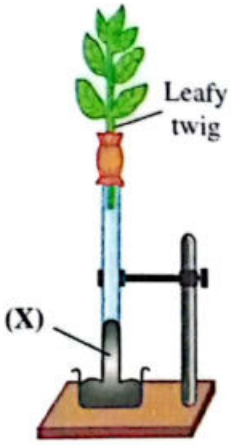
(c) Function. (d) Location.

41 In which of the following processes the plant gets rid of water by two different ways ?

(a) Respiration and transpiration. (b) Respiration and exudation.

(c) Guttation and exudation. (d) Transpiration and guttation.

**42** In the opposite figure :




(1) Which of the following disagrees with the precautions taken during this experiment ?

ⓐ The plug must be closed tightly.

ⓑ Putting the plant in an open area exposed to light.

ⓒ The density of liquid (X) is lower than the water density.

ⓓ Cutting the plant under the water surface.

(2) What do you expect for the surface of liquid (X), if the twig is replaced by another one with lower number of leaves ?

ⓐ The liquid level increases by the same rate.

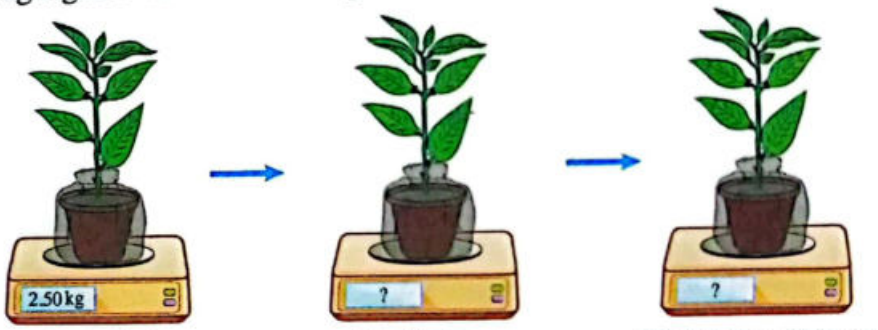
ⓑ The liquid level increases by lower rate.

ⓒ The level of the liquid remains constant without change.

ⓓ The level of the liquid decreases.

---

**43** The following figures illustrate an experiment that was carried out on a plant :




At the beginning of the experiment (1)

After 12 hours in light at 35°C (2)

After another 12 hours in light at 20°C (3)

Which of the following choices represents the weights of the plant in the two cases no. (2) and (3) respectively ?

ⓐ 2.45 kg / 2.1 kg. ⓑ 2.5 kg / 2.5 kg. ⓒ 2.3 kg / 2.25 kg. ⓓ 2.3 kg / 2.3 kg.

---

**44** ✳ Which of the following figures represents the diffusion of most of oxygen gas during night in a plant leaf ?

ⓐ ⓑ ⓒ ⓓ

45 ✳ What is the result of cultivating a plant in a calcareous soil ?

(a) An increase in the excretion of nitrogenous wastes.

(b) An increase in the photosynthesis rate.

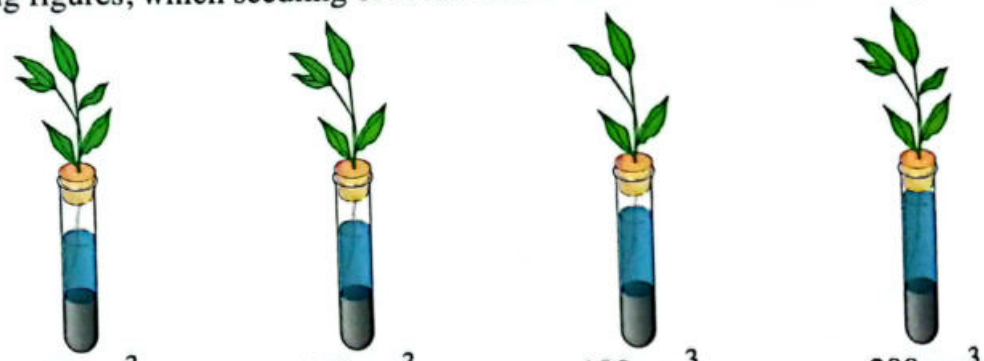
(c) An increase in the rate of leaves falling. (d) An increase in the transpiration rate.

46 ✳ Which of the following **isn't** from the forms of water loss in the herbaceous plants ?

(a) Stomatal transpiration. (b) Lenticular transpiration.

(c) Cuticular transpiration. (d) Guttation.

47 ✳ If four seedlings were put in four glass tubes, each tube contains 200 $cm^3$ of water, the tubes were left for two days in the same environmental conditions as illustrated in the following figures, which seedling of them whose leaves were covered by paraffin wax ?



180 $cm^3$ (a) 185 $cm^3$ (b) 190 $cm^3$ (c) 200 $cm^3$ (d)

48 ✳ How can the plant face the hot environmental conditions ?

(a) By increasing the respiration process rate. (b) By decreasing in the photosynthesis proces

(c) By stopping the transpiration process. (d) By increasing the water absorption rat

## Second Miscellaneous Questions

1 **Give reason for :** the metabolism of carbohydrates is better than the metabolism of proteins in plants.

2 **Explain :** the falling of leaves of some plants may be useful in the excretion process.

3 "The green plants can make benefit from the products of the catabolism process". **How far is this statement correct ? With explanation.**

4 **Explain :** the plant cells adapt to the nature of the metabolic wastes.

5 **Give reason for :** the transpiration process occurs mainly in the plant leaves.

6 "The excess water takes one pathway to be excreted from the plant".
**How far is this statement correct ? With explanation.**

7 **What is the difference between :** the transpiration in the herbaceous plants and the transpiration in the old woody plants ?

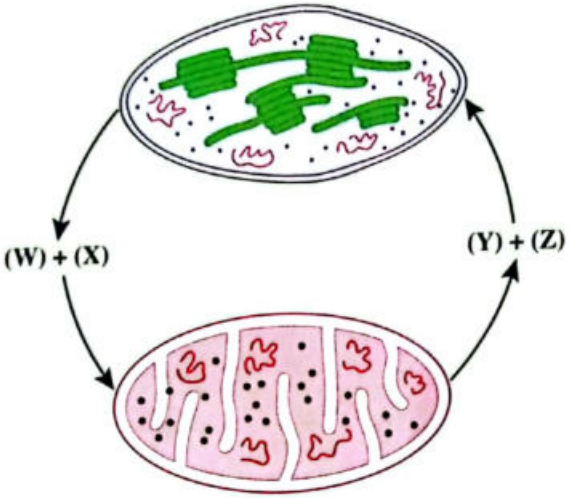
8 **What happens when :** a branch of the plant is not cut under the water surface in the experiment of proving the role of transpiration in the ascent of sap ?

## Questions that measure **high levels of thinking**

Answered in detail

**Choose the correct answer :**

1 The opposite figure shows the cycle of a biological process that takes place in the plant, if you know that each of (W) and (Z) contains carbon element in their structure, determine :




(1) What are the substances that are produced from catabolism ?

ⓐ (W) and (X). ⓑ (X) and (Z).
ⓒ (W) and (Y). ⓓ (Y) and (Z).

(2) What are the substances that come out from the leaves stomata through diffusion without changing their physical state ?

ⓐ (X) and (W). ⓑ (Z) and (X).
ⓒ (W) and (Y). ⓓ (Y) and (Z).

2 The following table illustrates some characteristics of four different plants that grow in the same environmental conditions, which one of the plants loses the highest amount of water ?

| Plant | Number of plant leaves | Average surface area of the leaf ($cm^2$) | Average number of stomata (per $mm^2$) |
|---|---|---|---|
| ⓐ | 12 | 42 | 248 |
| ⓑ | 25 | 20 | 250 |
| ⓒ | 35 | 52 | 275 |
| ⓓ | 36 | 45 | 150 |

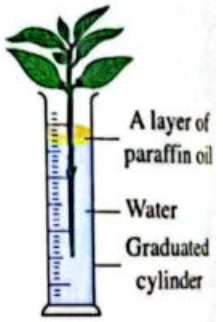
**3** In an experiment to measure the rate of transpiration, four symmetric plant leaves were chosen, the upper surface of leaf no. (1), the lower surface of leaf no. (2) and the upper and lower surfaces of leaf no. (3) were covered separately with vaseline, while leaf no. (4) was left as it is without treating. Which of the following choices represents the rate of water loss for the previous leaves from the highest loss to the least one after a period of time ?

ⓐ (1) ⟶ (4) ⟶ (3) ⟶ (2).  ⓑ (1) ⟶ (2) ⟶ (4) ⟶ (3).

ⓒ (4) ⟶ (3) ⟶ (1) ⟶ (2).  ⓓ (4) ⟶ (1) ⟶ (2) ⟶ (3).

---

**4** Four plant samples were put in four graduated cylinders containing 100 mL of water with a layer of paraffin oil on its surface as in the opposite figure, then they were exposed to different conditions of humidity and temperature for 48 hours, and then the total volume of water in cylinder no. (1), (3) and (4) was measured as in the following table :




| Plant sample | Humidity | Temperature (°C) | Total volume of water (mL) |
|---|---|---|---|
| (1) | Low | 5 | 75 |
| (2) | Low | 25 | ..... |
| (3) | High | 5 | 95 |
| (4) | High | 25 | 65 |

Which of the following choices expresses the total volume of water in cylinder no. (2) ?

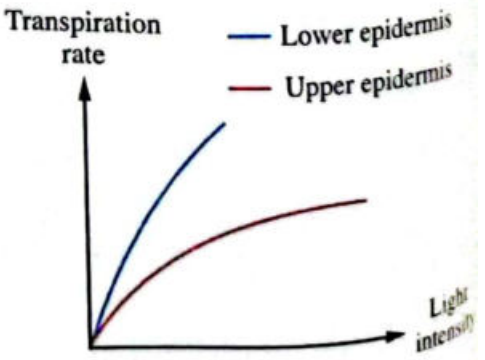
ⓐ Lower than 65 mL.  ⓑ Between 65 : 75 mL.

ⓒ Between 75 : 95 mL.  ⓓ Higher than 95 mL.

## Answer the following questions :

**5** The opposite graph illustrates the rate of transpiration in the upper and lower epidermises in a plant leaf when exposing it to light, this occurs when the other environmental conditions that may affect the rate of transpiration are fixed.

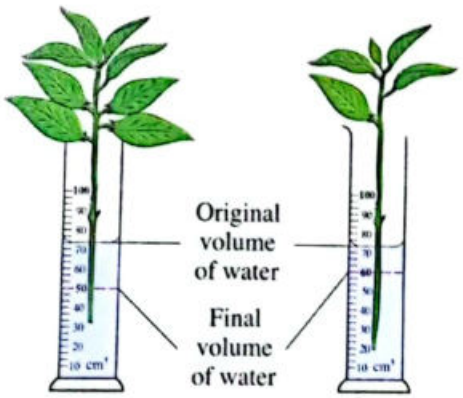
**Suggest a reason for the difference between the transpiration rate in the two surfaces.**



**6** **The opposite figure illustrates an experiment to measure the rate of transpiration of two plants under the same environmental conditions for 24 hours :**

(a) **What** is the reason for the difference in the water level in each of the two cylinders after finishing the experiment ?

(b) **What** is the required change in the experiment design for proving that the water loss is performed through the plant leaves ?



Test on Chapter 4

# Excretion in Living Organisms

**Choose the correct answer (1 : 20) :**

**1** Which of the following excretory products can the body get rid of it/them through the two kidneys, lungs and skin ?

ⓐ Spices. ⓑ Water. ⓒ Urea. ⓓ Salts.

**2** What is the difference between the means of excretion in the herbaceous plants and perennial trees ?

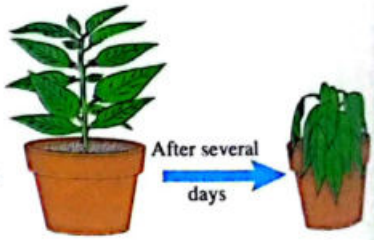
ⓐ Stomatal transpiration. ⓑ Cuticular transpiration.

ⓒ Lenticular transpiration. ⓓ Guttation.

**3** On examining a urine sample of a person after eating a meal containing a lot of meat in the previous day, which of the following will be found in the sample with a large percentage ?

ⓐ Protein. ⓑ Amino acids. ⓒ Urea. ⓓ Salts.

**4** From the opposite figure, which of the following can cause the changes occurred in the plant after several days ?




ⓐ The rate of water loss is higher than that of water absorption.

ⓑ The nutrients movement from the leaves to the stem.

ⓒ The rate of water absorption equals that of water loss.

ⓓ The rate of water absorption is higher than that of water loss.

**5** Which of the following **isn't** produced due to the presence of a disturbance in the action of Bowman's capsule ?

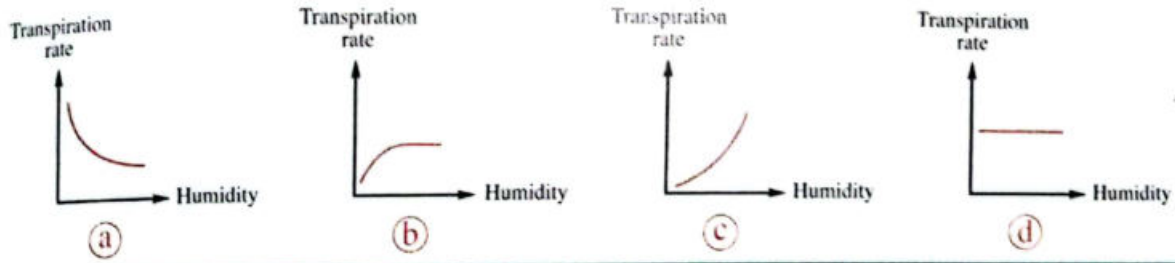
ⓐ The exit of urine with red colour.

ⓑ The presence of albumin in urine.

ⓒ The presence of white blood corpuscles in urine.

ⓓ The absence of protein from urine.

**6** Which of the following graphs expresses the relationship between the rate of transpiration in the leaves and the rate of atmospheric humidity ?

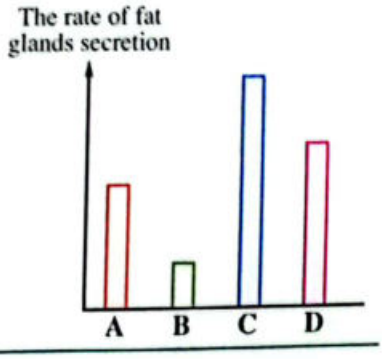



(a) (b) (c) (d)

**7** ✱ A person whose body contains 5 liters of blood, how many times does the total volume of blood pass through his two kidneys in 2 hours ?

(a) 75 times. (b) 60 times. (c) 30 times. (d) 15 times.

**8** The opposite graph illustrates the rate of fat glands secretion in four people, which choice represents the person whose hair is more exposed to splitting ?




(a) A (b) B

(c) C (d) D

**9** Which of the following can be observed on examining two equal amounts of urine and sweat for the same person ?

(a) The percentage of salts is equal in both of them.
(b) The percentage of water is equal in both of them.
(c) The percentage of nitrogenous wastes is higher in urine.
(d) The percentage of nitrogenous wastes is higher in sweat.

**10** Which of the following characterizes sweat in human from the transpiration water in plant ?

(a) It contains mineral salts.
(b) It decreases the body temperature.
(c) It passes through the plasma membranes.
(d) Its excretion increases with the increase of the surrounding temperature.

**11** ✱ If you know that the main function of loop of Henle is the reabsorption of water again from the nephric tubules, in which of the following living organisms do you expect that the loop of Henle is absent from the nephron structure ?

(a) Desert rats. (b) Wild birds. (c) Freshwater fish. (d) Lizards.

12 Which of the following characterizes the thick skin layer of an obese person from a slim person ?

ⓐ Its fullness with keratin.
ⓑ The presence of melanin granules.
ⓒ The adherence with the body muscles.
ⓓ It consists of connective tissue.

13 If you know that the concentration of glucose in the blood plasma is 0.1 g/100cm$^3$, when the selective reabsorption process is completed with an efficiency 100%, which of the following choices represents its concentration in the renal filtrate and urine of a healthy person respectively ?

ⓐ 0.1 / Zero. ⓑ Zero / 0.1 ⓒ 0.1 / 0.1 ⓓ Zero / Zero.

14 Which of the following **isn't** from the benefits of excretion process in human ?

ⓐ Maintaining the constancy of the blood structure.
ⓑ Maintaining the concentration of water and salts inside the body.
ⓒ Getting rid of the nitrogen gas that enters with the inhaled air.
ⓓ Getting rid of the metabolic wastes.

15 If we suppose that each collecting duct is connected to 10 nephrons. So, what is the approximate number of collecting ducts in the two kidneys ?

ⓐ 100 thousands. ⓑ 200 thousands. ⓒ 500 thousands. ⓓ One million.

16 Which of the following **isn't** correct about the stomatal transpiration and guttation processes ?

ⓐ It's impossible to occur at the same time.
ⓑ They differ in the amount of the lost water.
ⓒ They differ in the nature of the lost water.
ⓓ They are from the means of excretion in plant.

17 Which choice in the following table represents the body response on feeling the severe cold ?

| | Sweat secretion | Urine production | Blood capillaries in the skin |
|---|---|---|---|
| ⓐ | Increases | Increases | Constrict |
| ⓑ | Increases | Decreases | Dilate |
| ⓒ | Decreases | Increases | Constrict |
| | creases | Decreases | Dilate |

**18** When a student participated in a running competition for a distance of 800 meters, he observed an increase in his skin temperature, which of the following may be the reason for that ?

(a) Increasing the sweat that is secreted from the skin.

(b) Opening the sweat pores that are found on the skin surface.

(c) The constriction of the blood capillaries that are found in the skin.

(d) The dilation of the blood capillaries that are found in the skin.

**19** What is the blood vessel that contains the least percentage of urea ?

(a) Renal vein. (b) Hepatic vein. (c) Renal artery. (d) Hepatic artery.

**20** What is the resulted effect from practicing vigorous exercises on the amount of lost water from the body through the skin and kidneys than the normal rate respectively ?

(a) Decreases / Decreases. (b) Decreases / Increases.

(c) Increases / Decreases. (d) Increases / Increases.

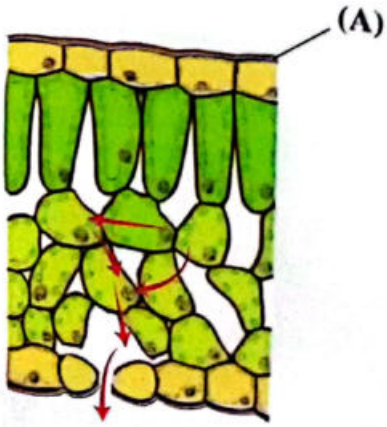
**Answer the following questions (21 : 23) :**

**21** **Explain :** the selective reabsorption process in the kidney includes active transport processes.

**22** **The opposite figure illustrates a part from the structure of plant leaf :**

**(a) What** is the type of transpiration that illustrated in the figure ?

**(b) What** is the percentage of the lost water from structure (A) with respect to the total water content that lost from the plant ?




**23** **Give reason for :** the trees with falling leaves can do the transpiration process in winter, despite falling of their leaves.

# Chapter Five

## Sensitivity in Living Organisms

**Why** do you think when touching the leaves of some plants, they droop ?

Chapter 5

Lesson One

# Sensation in Plant

- **Sensation (Sensitivity) is one of the living organism characteristics, as it occurs in all living organisms, starting with the unicellular organisms till reaching human to maintain their life, where we find that :**
  - Sensitivity in plants : is less obvious.
  - Sensitivity in animals : is more obvious.
  - Sensitivity in human : reaches the highest degree of efficiency and accuracy.

## Sensitivity (Irritability)

It is the suitable response of the living organism to the internal and external stimuli to maintain its life.

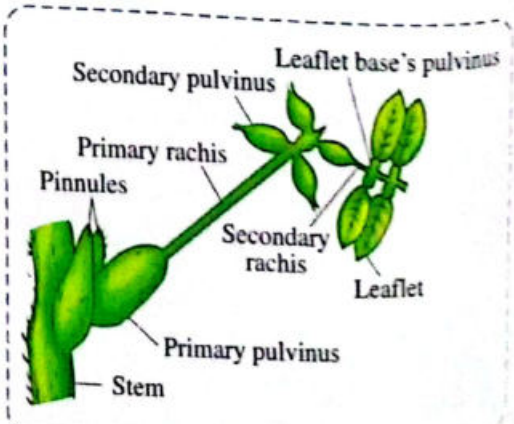
## Sensitivity in plants

- **Sensitivity in plants includes :**

**First** Response of plant to touch and darkness. **Second** Tropism.

## First Response of plant to touch and darkness

- This phenomenon is obvious through our observation to ***Mimosa*** **plant leaflets.**
- **The morphology of *Mimosa* plant leaves :**
  - The leaves are compound and pinnate.
  - Each leaf has a primary rachis which carries four secondary rachises at its end.
  - Each secondary rachis carries two rows of leaflets.
  - At the base of each primary and secondary rachises and leaflet, there is a swollen structure called pulvinus.




*Mimosa* plant

### Response of *Mimosa* plant leaflets to touch

- On touching *Mimosa* leaflets, they **droop** as if they wilted.
- Then the other neighbouring leaflets will soon **follow** and **droop**, till the effect is seen in all the leaflets, and the leaf petiole droops at the end.

### Response of *Mimosa* plant leaflets to darkness

- In daytime, the leaflets are **held in a horizontal position** (this represents a wake movement of the plant).
- At night, the leaflets **hang downwards** and fold their upper surfaces (this represents a sleep movement of the plant).

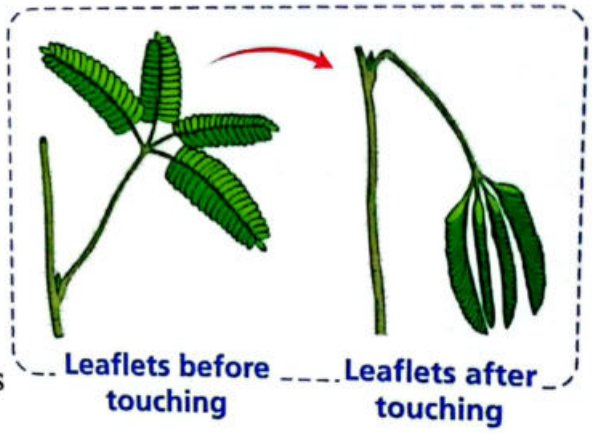
- **Explanation of *Mimosa* plant response to touch and darkness :**

This response is explained on the basis of filling the cells with water, where there are swollen structures (pulvini) at the base of rachises and leaflets of *Mimosa* plant which act as joints in these movements, **as follows :**

- The cell walls of the lower half of the pulvinus are thinner and more sensitive than those of the upper half and they play the main role in this movement.

- **When the leaflets are touched or in darkness :**
  - The primary rachises bend downward.
  - The secondary rachises droop.
  - The opposite leaflets fold over each other.

**This is due to** the shrinkage of the lower surfaces of pulvini and increasing the cells permeability, leading to the water diffusion from them to the neighbouring tissues, but when the stimulus is vanished, the cells regain water and the leaflets open once more.




**So, the *Mimosa* plant leaves can respond to touch and darkness as a type of sensitivity in the plant.**

## Do you know... ?

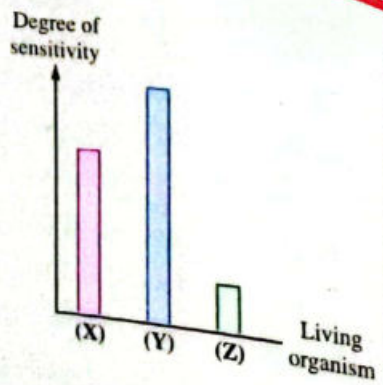
- When exposing the *Mimosa* plant to touch, chemical substances spread to each pulvinus "swollen structure" for stimulating the exit of water from it by osmosis phenomenon.

## Test yourself

Answered

**Choose the correct answer :**

1 The opposite graph illustrates three different levels of sensation for three living organisms, which choice represents organisms (X), (Y) and (Z) respectively ?




(a) Gorilla / Sunflower / Octopus.
(b) Sunflower / Gorilla / Octopus.
(c) Sunflower / Octopus / Gorilla.
(d) Octopus / Gorilla / Sunflower.

2 In which of the following cases the leaflets of *Mimosa* plant diverge from each other ?

(a) Touching the cells of the lower half of the leaflets pulvini.

(b) Touching the cells of the upper half of the leaflets pulvini.

(c) The water diffusion into the cells of the lower half of the leaflets pulvini.

(d) The water diffusion out of the cells of the lower half of the leaflets pulvini.

## Second Tropism

- Tropism process and subsequent movement represent the most common type of sensation in plant.

### Tropism

It is the curvature of the plant stem or root, when its sides are subjected to the effect of one of the factors (stimuli), such as light, humidity and gravity in an unequal form.

### Types of tropism

- Types of tropism are determined according to the affecting factor, **as follows :**

| 1 | 2 | 3 |
|---|---|---|
| Phototropism ⇩ Light | Geotropism ⇩ Gravity | Hydrotropism ⇩ Water |

### 1 Phototropism

### Phototropism

It is the response of the growing plant to an external stimulus which is **light**, causing the curvature of the plant parts towards or away from it.

### Practical activity 1 To prove the occurrence of phototropism

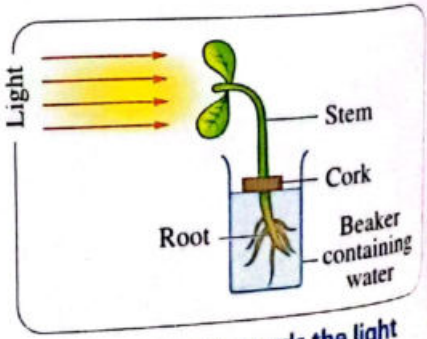
**Procedure**

(1) Place a straight seedling on a cork disc.

(2) Put the cork disc with the seedling in a beaker containing water.

(3) Put the beaker in a closed dark box that has a small circular hole in one side to admit the light passage.

(4) Leave it for several days.




Stem moves towards the light and root moves away from it

**Observations :**

(1) The stem's tip inclines towards the hole through which the light enters.
(2) The root inclines away from light.

**Conclusions :**

(1) The stem is positive phototropic.
(2) The root is negative phototropic.

**Explanation :**

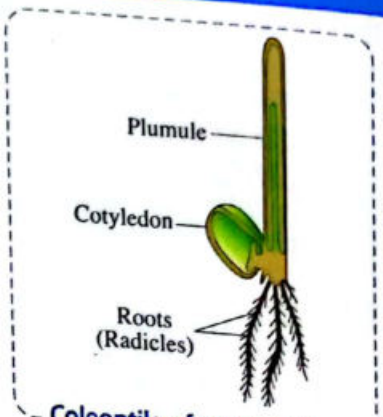
- The difference in the growth of the two sides of the root or stem which are near and away from the light source is **as follows :**
  (1) The side of stem which is **away from light** grows more rapidly than the side facing light. So, the stem curvature is towards light.
  (2) The side of root which is **near to light** grows more rapidly than the other side. So, the root curvature is away from light.

## Experiments to explain phototropism

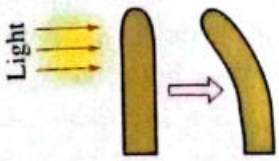
### Experiment 1 Boysen Jensen experiment

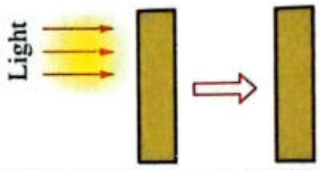
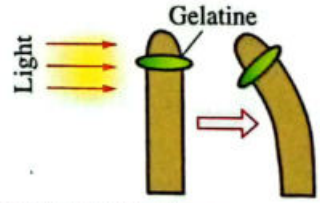
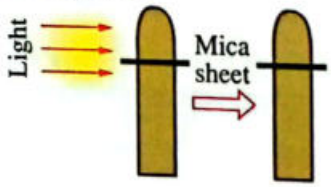
- **Boysen Jensen** explained this phenomenon through his observations and results of the experiments that were carried out on the oat *(Avena)* seedling coleoptile, **as follows :**

Boysen Jensen




Coleoptile of oat seedling

| Steps | Observations | Conclusions |
|---|---|---|
| ① Oat seedling was subjected to light from one side. | The curvature of the seedling will be towards the light source.   | The tip of the seedling coleoptile has synthesized chemical substances called "auxins" that affect the growth region and cause the tropism. |

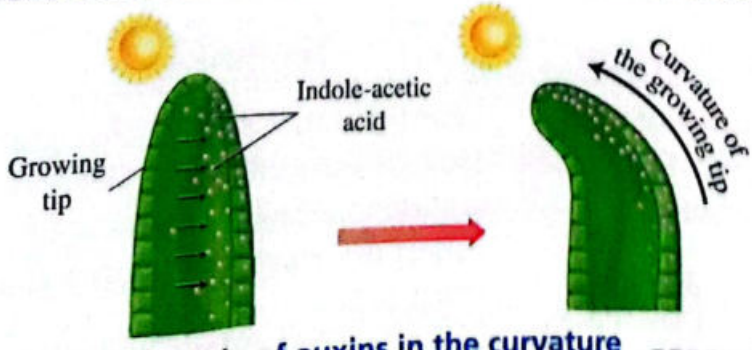
| | | |
|---|---|---|
| ② Cut off the coleoptile's tip of oat seedling (1 - 2 mm of the tip), then it is subjected to light from one side. | The plant coleoptile loses its ability to bend towards the light source.   | The coleoptile's tip is the source of auxins which cause the tropism. |
| ③ The decapitated tip is returned or fixed again directly to the coleoptile or with gelatine. | The coleoptile restores its ability to bend towards the light source.   | Auxins can diffuse through the gelatine and affect the growth again. |
| ④ The tip is separated again from the coleoptile with a mica sheet. | The coleoptile loses its ability to bend again.   | Auxins can't diffuse through the mica sheet. |

**Explanation**

The curvature towards light **(phototropism)** occurs as a result of the presence of unequal concentrations of **auxins** on the two sides of the coleoptile's tip of the seedling, which causes the unequal growth of the two sides of the part that is exposed to light.

## Auxins

They are chemical substances that are secreted from the growing tip of the plant and affected mainly by the external factors.




The role of auxins in the curvature of the growing tip of stem

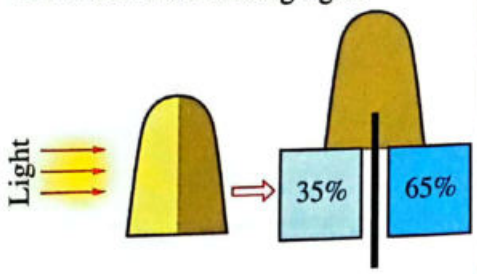
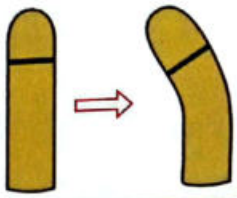
**Note**

The chemical structure of auxins has been known, and it was found that the most common type of auxins is indole-acetic acid (IAA).

# Experiment 2 Went's experiment

- He carried out his experiments to verify the results of **Boysen Jensen** experiments, **as follows :**

Went

| Steps | Observations | Explanation |
|---|---|---|
| 1 He exposed an oat seedling's coleoptile to a suitable light (from one side), then he cut off the tip and placed it on two blocks of agar that were separated by a metallic sheet, then he measured the concentration of auxins in each block. | The accumulation of :<br>• 65% of auxins in the agar block that touches the side which is away from light.<br>• 35% of auxins in the agar block that touches the side facing light.<br>  | Auxins move from the side facing light to the far (dark) side in the two agar blocks by diffusion in unequal ratios. |
| 2 He put this tip on a decapitated coleoptile which is not subjected to the light and waited for a while. | The coleoptile's tip will be curved.<br>  | The curvature of the coleoptile's tip is due to the difference in the concentration of auxins in the added tip. |

**Do you know... ?**

- Agar is a gelatinous substance that is extracted from the cell walls of red algae.

## General explanation for the results of phototropism experiments

| Stem is positive phototropic | Root is negative phototropic |
|---|---|
| Auxins move from the side facing light of the stem to the far side, leading to the elongation of the far side cells more than those of the side facing light, therefore the curvature of stem towards light occurs. | The accumulation of auxins on the dark side of the root produces an opposite effect, where the elongation is inhibited in the dark side cells, while the illuminated side cells continue in growing. So, the root bends away from light. |

**Explanation for the difference in the auxins' effect on each of the root and stem**

The concentration of auxins which is required for the elongation of root cells is much less than that required for the elongation of stem cells. As a result of the increase in the auxins' concentration above a certain limit in the root leads to an opposite effect, **i.e.** it inhibits the root cells elongation, whereas it activates the elongation of stem cells.

## Test yourself

**Choose the correct answer :**

**1** **By using the following figures, answer the following questions :**

**(1)** Decapitated coleoptile's tip.

**(2)** Coleoptile's tip is removed, then the agar disc placed between it and the stem.

**(3)** Growing tip is covered by a black cover.

**(4)** Growing tip.

**(5)** Growing tip is removed, then placed on a mica sheet.

**(6)** Growing tip is removed and replaced by a disc of agar.

**(1)** What are the stems that grow and directed towards light, if they are exposed to light from one side ?

(a) (1) and (2). (b) (2) and (3). (c) (2) and (4). (d) (3) and (6).

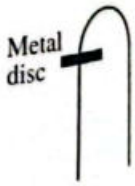
**(2)** What is(are) the stem(s) that is(are) considered a model for the comparison among the other growing tips ?

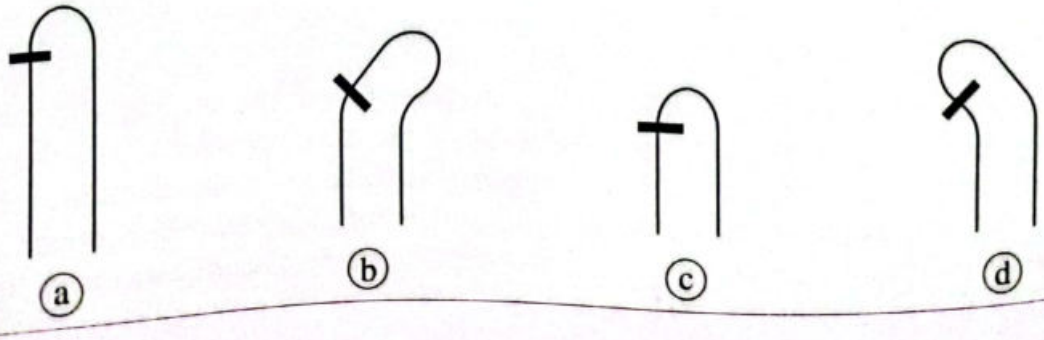
(a) (1) only. (b) (2) and (6). (c) (2) and (5). (d) (4) only.

**(3)** What are the stems that grow vertically upward, if they are exposed to light from all directions ?

(a) (1), (2) and (3). (b) (2), (3) and (4). (c) (3), (4) and (5). (d) (4), (5) and (6).

**2** The opposite figure shows a part of a plant stem placed in a dark place, what is the expected result when placing it for several days ?



(a) (b) (c) (d)

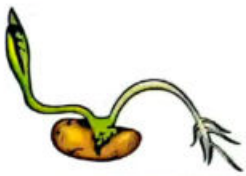
## 2 Geotropism

- It was believed that the root grows downward, in order to avoid light and seek for nutrients, but this belief is incorrect, as when you hang a pot with a plant upside down for a certain time, the root grows downward (not to the soil), but towards the gravity, while the stem grows upward away from the gravity.
- Scientists named this phenomenon by geotropism.

**Geotropism**

It is the response of the growing plant parts to an external stimulus which is **gravity**, where they bend towards or away from it.

### Practical activity 2 To illustrate the effect of gravity on the root and stem

| Steps | Observations |
|---|---|
| 1 Some seeds are germinated in a soil that is moistened with water **(in a vertical position)**. | Plumules grow vertically upward, while radicles grow vertically downward.  |
| 2 One seedling is placed **in a horizontal position**, then left for several days. | The plumule's tip bends upward against gravity and the radicle's tip bends downward with gravity.  |

**Conclusions**

- Stems are negative geotropic.
- Roots are positive geotropic.

**Explanation**

The curvature is due to the difference in the growth of the two sides of the organ (stem – root), as a result of the unequal distribution of auxins in the plant organ.

## General explanation for geotropism

- **When the plant grows in its normal vertical position :**

Auxins will be equally distributed in the two sides of the coleoptile's tips of both root and stem. So, **the stem grows vertically upward, while the root grows downward.**

- **When the plant grows in a horizontal position :**

Auxins accumulate in the lower side of both root and stem, **where :**

In stem : auxins activate the growth and elongation of the cells of the lower side more than those of the upper side, so the stem tip curves upward against gravity (**negative geotropic**).

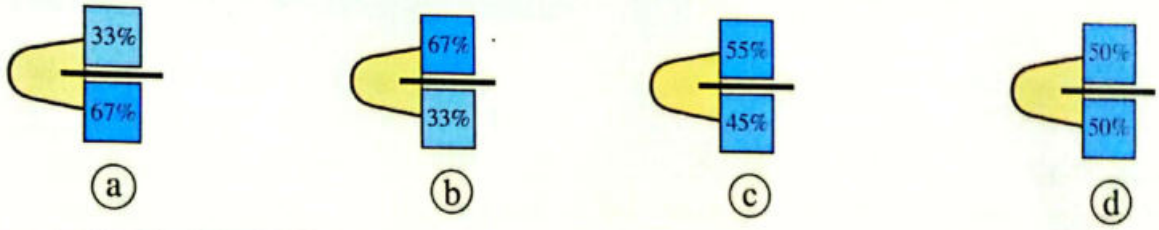
In root : auxins inhibit the growth and elongation of the lower side cells, while the cells of the upper side continue in growing and elongating. So, the root's tip bends downward with gravity (**positive geotropic**).

## Test yourself

Answered

**Choose the correct answer :**

Which of the following figures illustrates the distribution of auxins in the decapitated coleoptile's tip of oat seedling that separated then placed horizontally on two pieces of agar that are separated by a metallic sheet ?



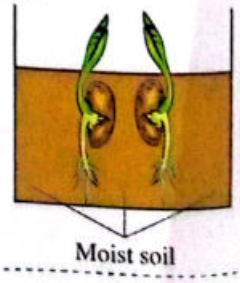
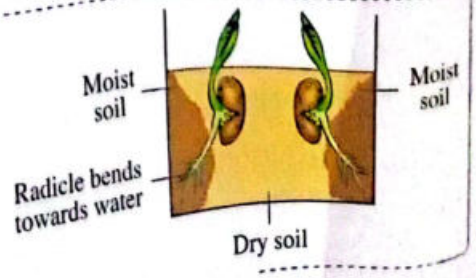

## 3 Hydrotropism

### Hydrotropism

It is the response of the plant parts to an external stimulus which is **humidity**, where they bend towards or away from it.

### Practical activity 3 To prove the hydrotropism phenomenon

- Germinate some seeds in two identical glass troughs containing two equal amounts of dry soil, **then follow the following steps :**

| Steps | Observations |
|---|---|
| 1 Water the soil at regular intervals in **the first trough,** and after several days notice the seeds growth. | Roots grow straightly and vertically downward.   |
| 2 Spray water at the sides only of **the second trough**, and after several days notice the seeds growth. | Roots grow curved towards the water that is present at the sides.   |

**Explanation**

| | |
|---|---|
| ① Roots grow vertically without curvature, due to the equal distribution of water in the soil around the root. | ② Roots grow curved, due to the presence of water at the trough sides and its absence in the middle of the trough, leading to the unequal distribution of water around the root. |

## General explanation for hydrotropism

**The root is positive hydrotropic,** as auxins accumulate in the root side that faces water, inhibiting its cells elongation, while the cells of the far side continue in their normal growth and elongation, leading to the curvature of root towards water.

**The following table summarizes the types of tropism and their effects on the root and stem :**

| Type of tropism / Its site | Phototropism | Geotropism | Hydrotropism |
|---|---|---|---|
| Stem | Positive | Negative | No effect |
| Root | Negative | Positive | Positive |

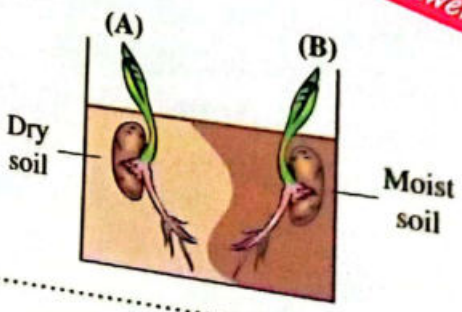
## Key Points

- **Tropism occurs at the same direction of the accumulation of auxins in case of :**
  1. Negative phototropism for the root in vertical position.
  2. Positive geotropism for the root in horizontal position.
  3. Positive hydrotropism for the root.
- **Tropism occurs in the opposite direction of the accumulation of auxins in case of :**
  1. Positive phototropism for the stem in vertical position.
  2. Negative geotropism for the stem in horizontal position.

## Test yourself

Answered

**Study the opposite figure, then determine the mistake that is found in it. Explain your answer.**

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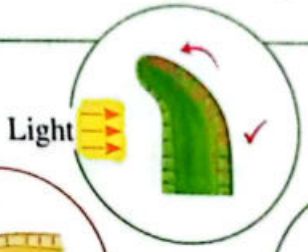
## From the previous, we can summarize the effect of light, gravity and humidity on each of the stem and root in the following diagram :

✓ Activation of the side elongation.
× Inhibition of the side elongation.
Direction of the curvature.
Auxins

### The effect of light on the stem in vertical position

Auxins transfer from the side facing light to the side which is away from light, **leading to :**

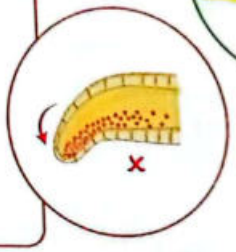
- The elongation of the cells of the side that is away from light more than that of the side facing light.
- The curvature of the stem towards light.




### The effect of gravity on the root in horizontal position

Auxins accumulate in the lower side of the root, **leading to :**

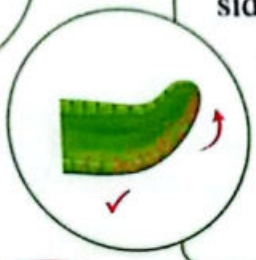
- The inhibition of the elongation and growth of the cells of the lower side, while the cells of the upper side continue in growing and elongation.
- The curvature of the root's tip downward with gravity.




### The effect of gravity on the stem in horizontal position

Auxins accumulate on the lower side of the stem, **which leads to :**

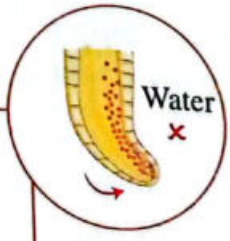
- The activation of the growth and elongation of the lower side cells by a greater degree than that of the upper side cells.
- The curvature of the stem's tip upwards against gravity.




### The effect of water on the root in vertical position

The accumulation of auxins in the side facing water, **which leads to :**

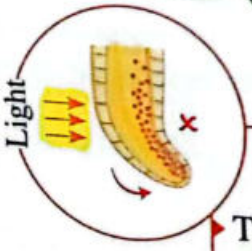
- The inhibition of the elongation and growth of the cells of this side, while the growth and elongation of the cells of the other side continue.
- The curvature of the root towards water.




### The effect of light on the root in vertical position

The accumulation of auxins in the dark side of the root, **which leads to :**

- The inhibition of the elongation and growth of the cells of this side, while the growth of the cells of the illuminated side continues.
- The curvature of the root away from light.



Chapter 5

Questions on Lesson One

# Sensation in Plant

GPS

The questions signed by ✻ are answered in detail. Understand Apply Analyze

Interactive test

## First Multiple Choice Questions

1 Which of the following **isn't** necessarily related to sensation ?
(a) Response. (b) Stimulus. (c) Receiving. (d) Movement.

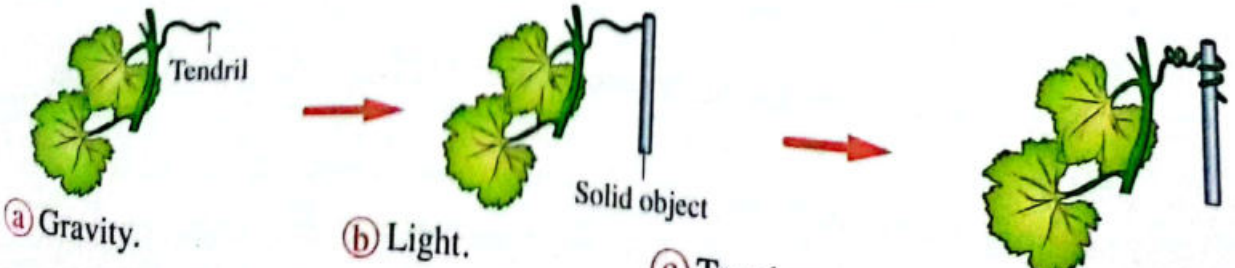
2 Which of the following characterizes the sensation in bean plant comparing to that in the spider ?
(a) It is less obvious.
(b) It is more obvious.
(c) It occurs without the action of hormones.
(d) It reaches the highest degree of efficiency and accuracy.

3 Which of the following statements agrees with the sensation process in the plant ?
(a) The sensation in plant is restricted on some species, such as *Mimosa* plant.
(b) The sensation in plant decreases, when the plant structure becomes complicated.
(c) The sensation in plant depends on external and internal factors.
(d) The plant life doesn't depend on the sensation process.

4 What happens to the cells of the lower surface of pulvini at the base of the pinnate leaves of *Mimosa* plant, once shining the daylight ?
(a) The water permeability to inside them decreases.
(b) The salts permeability to outside them increases.
(c) The water permeability to inside them increases.
(d) The salts permeability to inside them increases.

5 Which of the following structures are found in *Mimosa* plant and similar to the action of joints in human ?
(a) Leaflets.
(b) The primary rachises.
(c) The secondary rachises.
(d) Pulvini.

6 The following figures represent a kind of plants that is characterized by the presence of spiral structures that help them in being attached to the support, which are called tendrils for normal growth. What is the factor which stimulates the tendrils of this plant to wrap around the supports ?




(a) Gravity. (b) Light. (c) Touch. (d) Water.

7 What is the biological process that expresses the flowers blooming in some plants at daytime and their closure at night ?

ⓐ Respiration. ⓑ Excretion. ⓒ Photosynthesis. ⓓ Sensation.

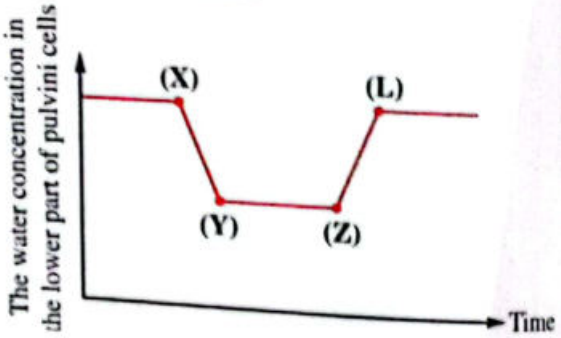
8 If the primary pulvinus in a leaf of *Mimosa* plant shrinks, what is the number of leaflets' rows that will bend downward ?

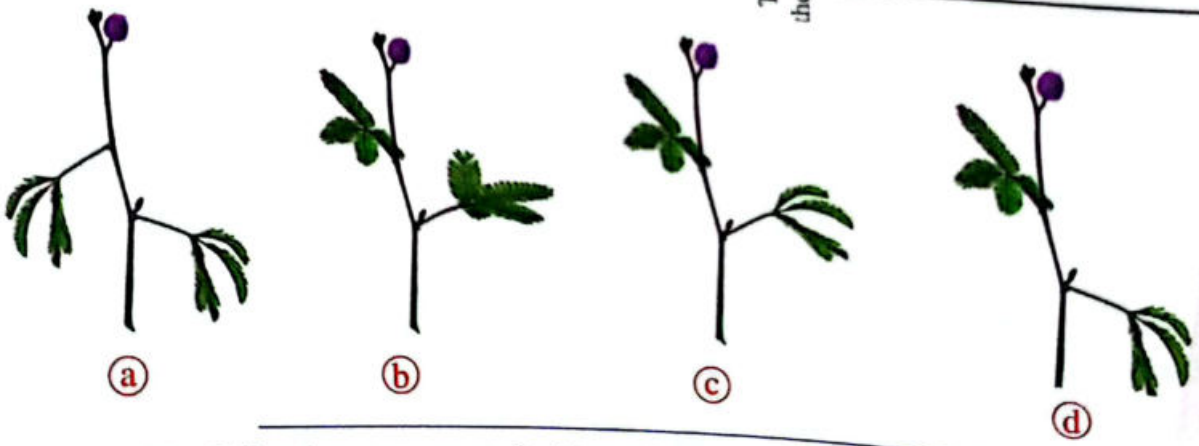
ⓐ 4 rows. ⓑ 8 rows. ⓒ 16 rows. ⓓ 32 rows.

9 Which of the following parts in *Mimosa* plant **doesn't/don't** respond to sensation ?

ⓐ Leaflets ⓑ Pulvini.
ⓒ Stem. ⓓ Secondary rachises.

10 From the opposite graph, which of the following figures represents the response of the plant leaves within (Y – Z) time period ?




11 Which of the following statements **isn't** applied to auxins ?

ⓐ They are greatly affected by the environmental factors.
ⓑ They can't penetrate through the agar pieces.
ⓒ They are used by the human to increase the rate of the plant growth.
ⓓ They are chemical substances that are secreted by the plant buds.

12 Which of the following statements agrees with the nature of auxins action ?

ⓐ When their concentration increases in the root cells, this leads to the activation of their elongation.
ⓑ When their concentration decreases in the stem cells, this leads to stopping their elongation.
ⓒ They are not affected by the external stimuli in all conditions.
ⓓ They flow from up to down in the horizontal position of the seedling.

**13** Which of the following statements is correct ?

(a) The presence of auxins in the cells always leads to their elongation.

(b) The decrease of auxins from the cells always inhibits their growth.

(c) The auxins are not related to the growth of cells.

(d) The effect of auxins on the growth differs, according to the site of their presence.

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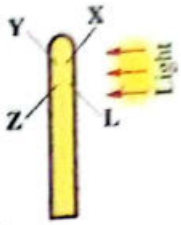
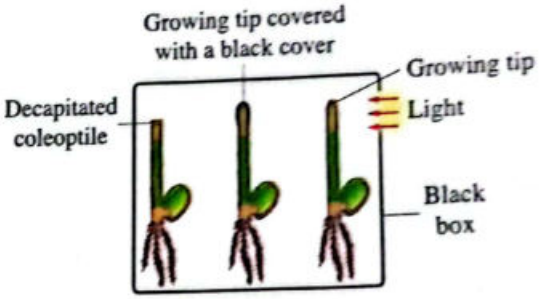
**14** When carrying out an experiment to verify the phototropism, a plant stem was exposed to light from one side only, which of the illustrated regions in the opposite figure has the highest rate of growth ?

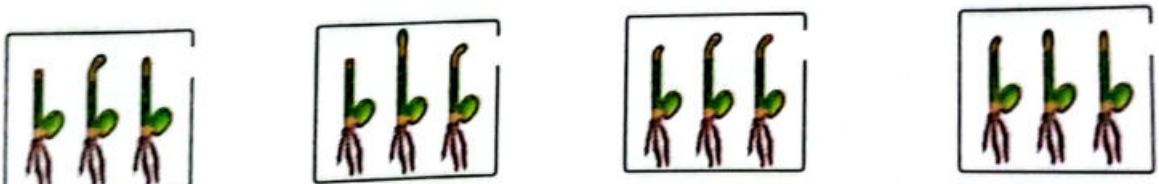



(a) X (b) Y (c) Z (d) L

---

**15** The opposite figure illustrates an experiment that is used to prove the effect of light on the growth of three plant seedlings, which of the following figures illustrates the probable result of the response of seedlings after several days ?



(a) (b) (c) (d)

---

**16** Which of the following illustrates the effect of high concentration of auxins ?

(a) Increase in the elongation of root cells.

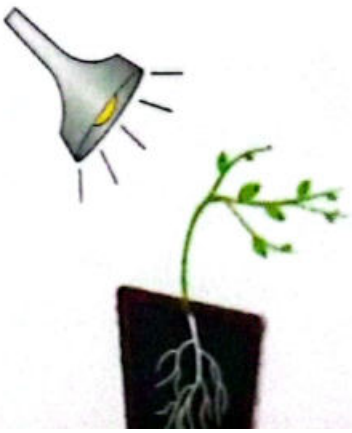
(b) Increase in the elongation of root and stem cells.

(c) Decrease in the elongation of stem cells.

(d) Inhibition of the elongation of root cells.

---

**17** A student put a curved plant in a pot, then the pot is subjected to light as shown in the opposite figure. Which of the following observations describes the plant direction within several days ?



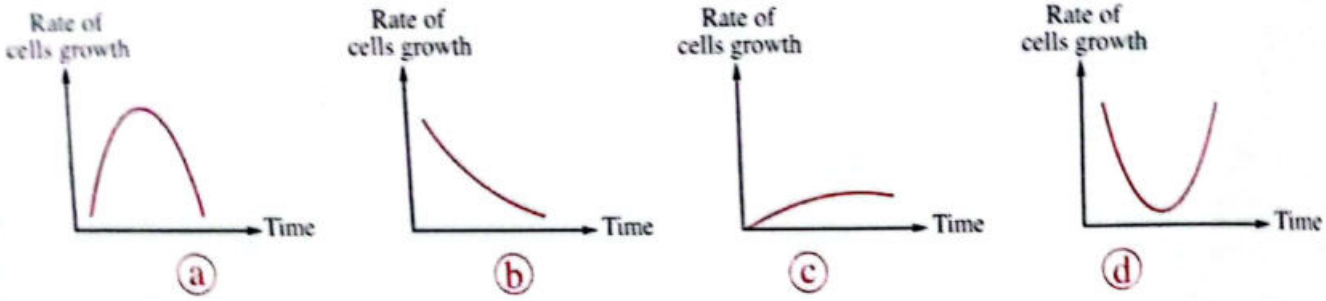
(a) It grows in the direction of light directly.

(b) Its growth continues away from light.

(c) It grows vertically, then in the direction of light.

(d) It continues growing upward.

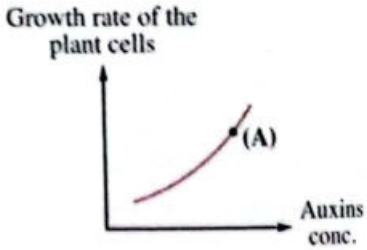
**18** A plant is put inside a beaker containing water, then it is exposed to light from one side for several days. Which graph represents the growth of the cells of the part that faces the light in the root of this plant ?




(a) (b) (c) (d)

---

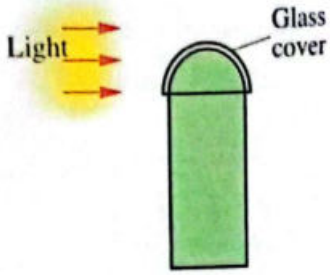
**19** Which of the following represents the effect of auxins concentration on point (A) in the opposite graph ?




(a) It inhibits the stem growth.
(b) It activates the stem growth.
(c) It inhibits the root growth.
(d) It activates the root growth.

---

**20** The opposite figure represents a plant stem whose tip is covered by a glass cover, what would happen to it after several days ?




(a) Its growth stops.
(b) It grows vertically upward without any curvature.
(c) It bends towards the light direction.
(d) It bends opposite to the light direction.

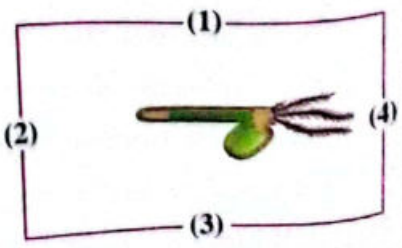
---

**21** Which of the following is correct for each of the phototropism in a vertical position and geotropism in a horizontal position for the root ?

(a) Auxins act in the same direction of the stimulus.
(b) Auxins get away from the stimulus.
(c) The excess auxins inhibit the growth of cells.
(d) The excess auxins stimulate the growth of cells.

---

**22** The opposite figure illustrates a coleoptile's tip of a plant hanged in a horizontal position inside a box, from which of the following openings can the coleoptile's tip of the stem be exposed to light, as it **doesn't** interfere with its negative geotropism ?




(a) (1). (b) (2).
(c) (3). (d) (4).

23 Which of the following statements **isn't** correct ?

ⓐ Humidity affects the auxins that control the growth of root.
ⓑ Humidity doesn't affect the auxins that control the growth of stem.
ⓒ Gravity affects the auxins that control the growth of stem.
ⓓ Light doesn't affect the auxins that control the growth of stem.

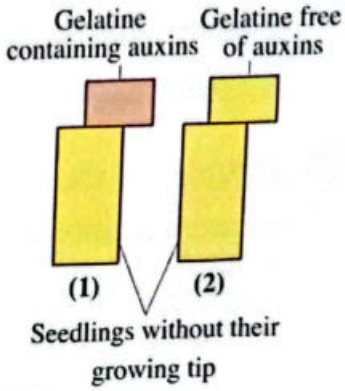
24 Which of the following statements **isn't** correct ?

ⓐ The stem is positive phototropic and negative geotropic.
ⓑ The stem is negative geotropic and positive hydrotropic.
ⓒ The root is negative phototropic and positive hydrotropic.
ⓓ The root is positive geotropic and positive hydrotropic.

25 ✻ Study the opposite figure that illustrates a part of *Mimosa* plant, what is the number of regions that move in darkness in the shown part ?

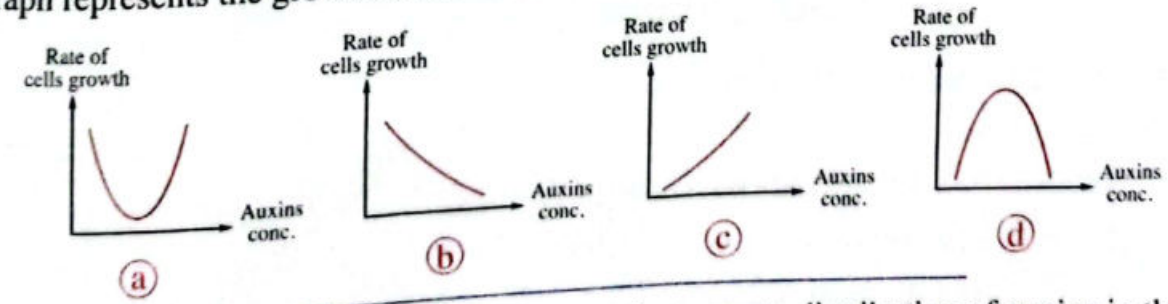
ⓐ 1 ⓑ 3
ⓒ 6 ⓓ 9

26 ✻ From the opposite figure, what do you expect to happen in each of the two figures no. (1) and (2) ?



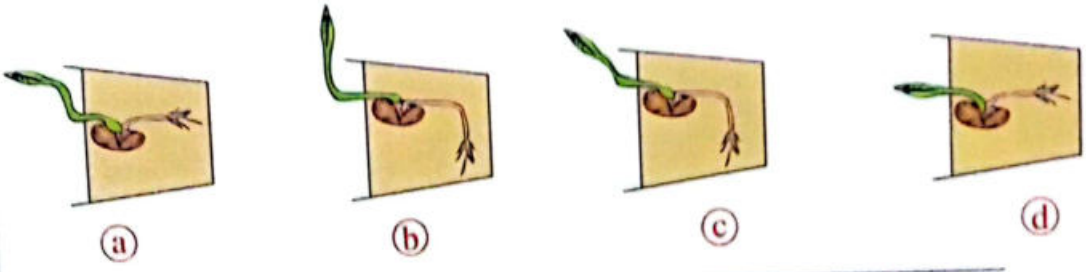

ⓐ Seedling no. (1) bends towards the left side, while seedling no. (2) doesn't bend.
ⓑ Seedling no. (2) bends towards the left side, while seedling no. (1) doesn't bend.
ⓒ The two seedlings bend towards the left side.
ⓓ The growth of the two seedlings stops in the two cases.

27 ✻ A growing plant stem is exposed to light from one side for a period of time, which graph represents the growth of the cells that are away from light in the stem of this plant ?




28 ✻ Which of the following figures represents the accurate distribution of auxins in the tip of oat seedling coleoptile that is exposed to light from the right side ?

29 ✱ The opposite figure represents a plant seedling in a pot that was placed on one of its sides, which of the following figures expresses what will happen for the seedling after several days ?



(a) (b) (c) (d)

30 ✱ In which of the following cases the tropism occurs in the opposite direction of auxins accumulation ?

(a) Stem in a horizontal position and another one in a vertical position exposed to light from one side.

(b) Root in a horizontal position and another one in a vertical position exposed to water from one side.

(c) Stem and root in a vertical position that are exposed to light from one side.

(d) Stem and root in a horizontal position.

31 ✱ Which of the following cells the speed of their division increases, due to the accumulation of auxins in them ?

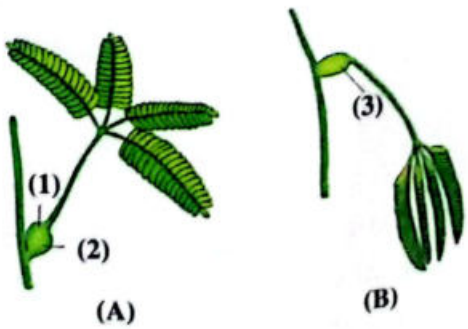
(a) The side of stem facing light. (b) The side of root facing water.

(c) The upper side of root in a horizontal position.

(d) The lower side of stem in a horizontal position.

## Second Miscellaneous Questions

1 **The two opposite figures illustrate two cases of *Mimosa* plant :**




- **(a) What** does each of (A) and (B) represent ?
- **(b) What** is the difference between the cells of part no. (1) and the cells of part no. (2) ?
- **(c) Is** there a difference between the cells of part no. (2) and the cells of part no. (3) ? **Explain your answer.**
- **(d) In which** case (A) or (B) does the efficiency of the plant to perform photosynthesis process increase ? **Explain your answer.**

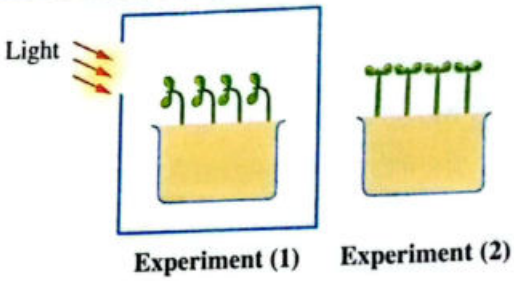
**2** **What happens in case of :** the absence of pulvini from the leaflets of *Mimosa* plant ?

**3** **Explain :** the movement of *Mimosa* plant depends on external and internal factors.

**4** **In the two opposite figures :**

**(a) What** is the name of the phenomenon that takes place in experiment no. (1) ?

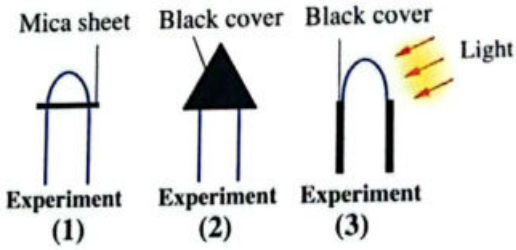
**(b) Explain** the results of the two experiments no. (1) and (2).




**5** **In front of you, a group of experiments that are carried out to study the effect of the exposure to light from one side only, on the growth of coleoptiles of oat plant seedlings :**

**(a) What** is the expected result for each experiment ?

**(b) Explain** your answer for the results of experiments no. (1) and (2) only.




**6** "The positive tropism of the root is associated with the increase in auxins percentage in the side facing the stimulus, according to its type". **How far is this statement correct ? With explanation.**

**7** **Compare between :** hydrotropism and phototropism.

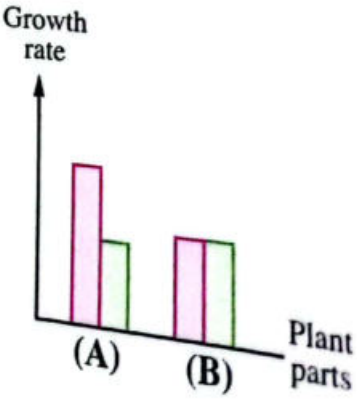
**8** **Explain :** the effect of auxins is different, according to their site of presence in the plant.

**9** **Explain :** the substances that were used by the scientists to explain the role of auxins in the plant are various.

**10** **The opposite figure represents the changes that occur to the cells of the two sides of a growing tip in the parts of a plant that irrigated from one side :**

**(a) What** does part (A) refer to ?

**(b) What** is the reason for no change in part (B) ?

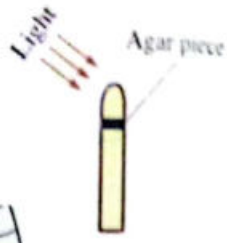


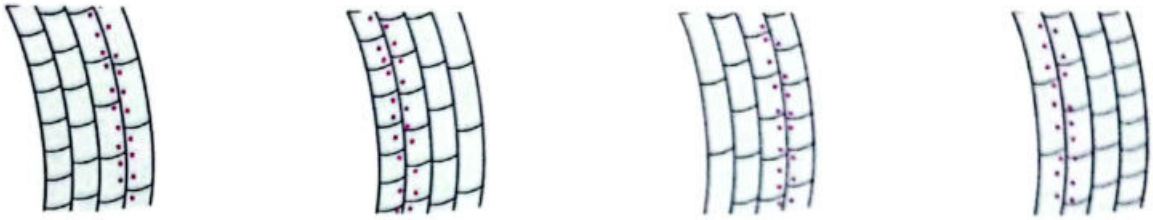
## Questions that measure **high levels of thinking**

Answered in detail

### Choose the correct answer :

**1** In the following figures, the red dots express auxins, which figure expresses a longitudinal section of the coleoptile's tip that illustrated in the opposite figure after a period of time ?

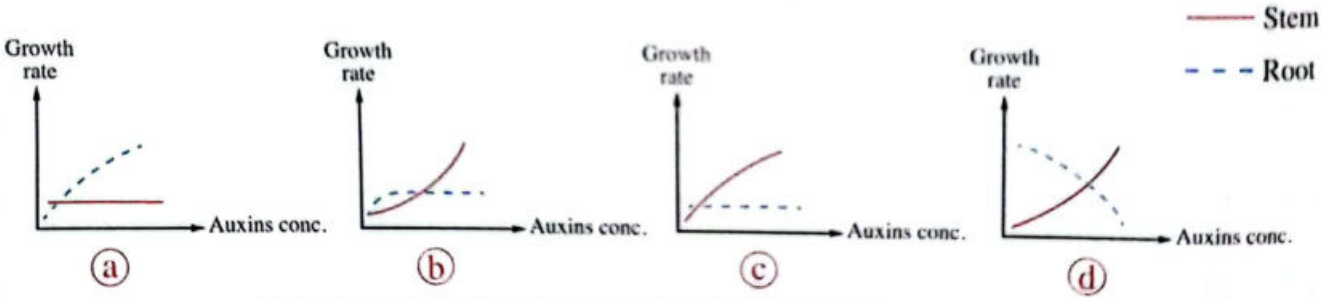


(a) (b) (c) (d)

---

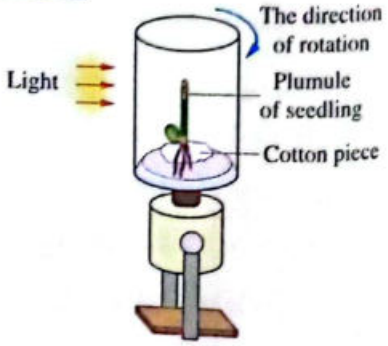
**2** In an experiment to prove the auxins role in the plant growth, indole-acetic acid is added gradually to a soil that contains a bean plant seedling, which of the following graphs represents the effect of increasing the auxins concentration on the growth of the growing tip's cells for each of the stem and root of this seedling ?

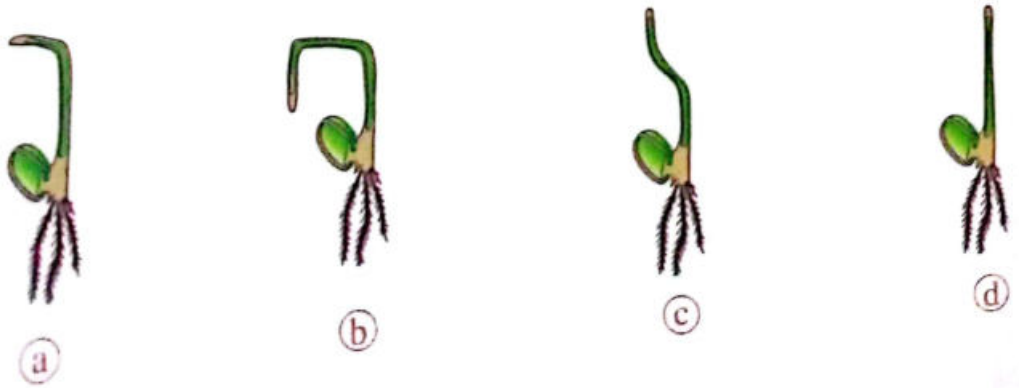



(a) (b) (c) (d)

---

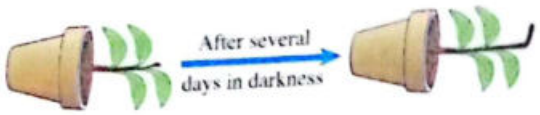
**3** The opposite figure represents a plant seedling fixed on a surface rotating horizontally and exposed to light from one side only, the seedling has been rotated for two days, then left fixed for another two days. Which of the following figures illustrates what would happen to the plumule of seedling after four days ?



(a) (b) (c) (d)

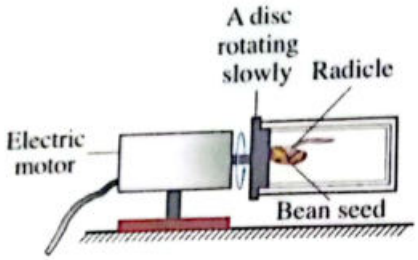
**4** The opposite figure illustrates an experiment that carried out to verify the response of a plant stem to gravity, which of the following figures shows the control sample for this experiment ?

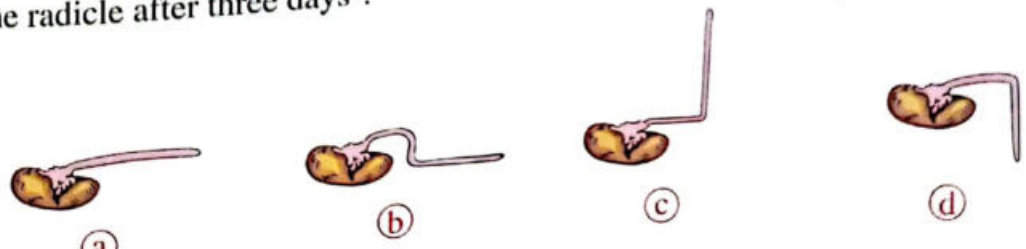




ⓐ ⓑ ⓒ ⓓ

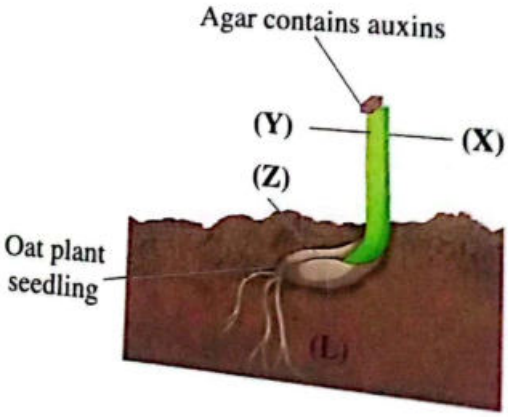
**5** The opposite figure illustrates a growing seed of bean plant with a radicle in a horizontal position, where it was placed on a disc rotating vertically around itself in a slow manner for three days, which of the following figures illustrates the shape of the radicle after three days ?



ⓐ ⓑ ⓒ ⓓ

**6 From the opposite figure :**




(1) Which of the following sides whose cells are elongated ?

ⓐ (X) and (Y).

ⓑ (X) and (L).

ⓒ (X) and (Z).

ⓓ (Y) and (Z).

(2) Which of the following sides whose cells are inhibited ?

ⓐ (X) and (Y). ⓑ (X) and (L).

ⓒ (X) and (Z). ⓓ (Y) and (Z).

**7** In which cells of the following parts do the accumulated auxins have the same effect according to the phototropism of a plant in a vertical position and the geotropism of a plant in a horizontal position ?

ⓐ The side of stem that is away from light and the lower surface of stem in a horizontal position.

ⓑ The side of stem facing light and the upper surface of stem in a horizontal position.

ⓒ The side of stem that is away from light and the upper surface of root in a horizontal position.

ⓓ The side of stem that is away from light and the lower surface of root in a horizontal position.

---

**8** In which of the following cases auxins inhibit the elongation of cells that are away from the stimulus ?

ⓐ The phototropism of root.

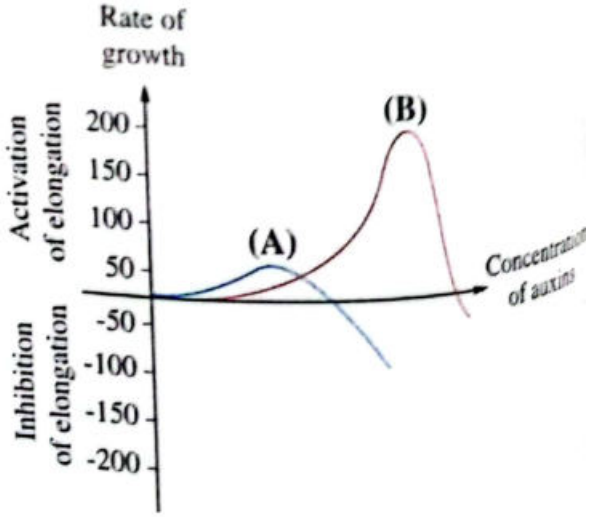
ⓑ The hydrotropism of root.

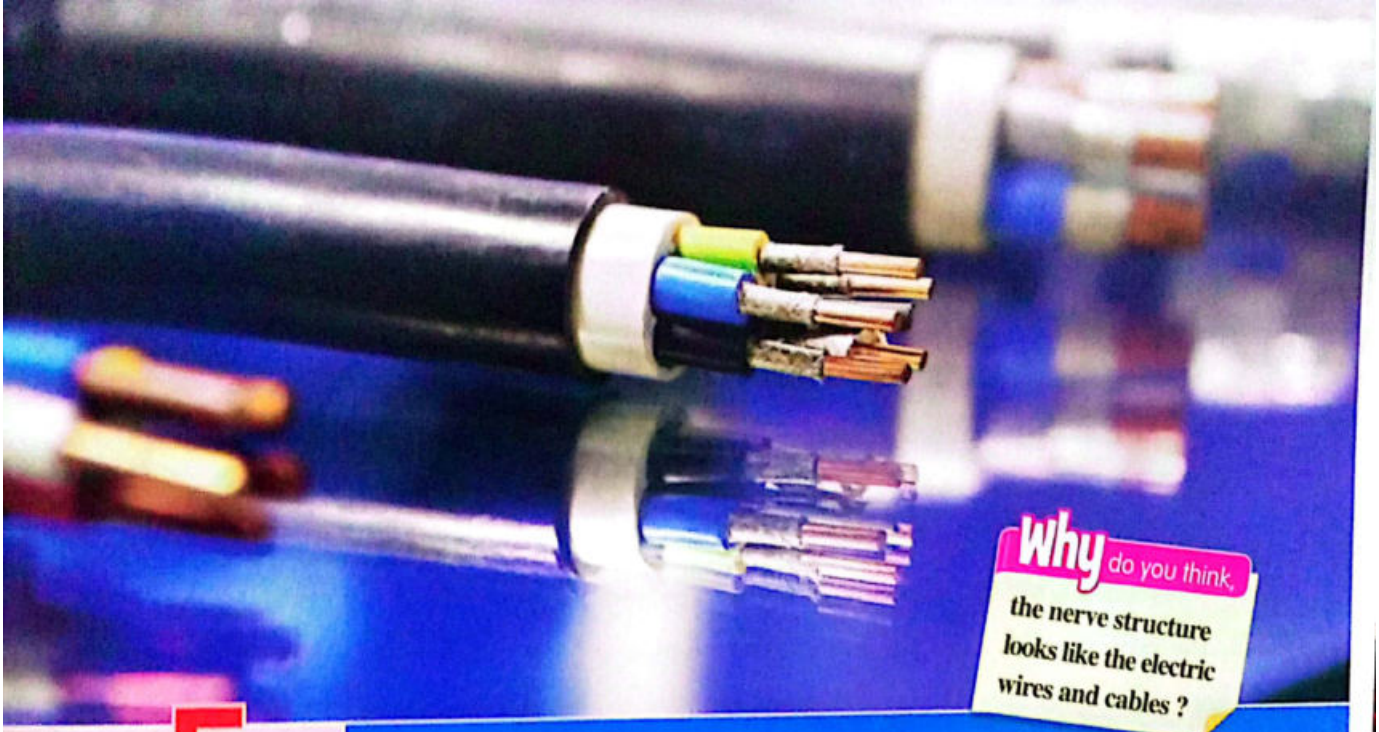
ⓒ The geotropism of stem in the horizontal position.

ⓓ The geotropism of root in the vertical position.

**Answer the following question :**

**9** The opposite graph represents the relationship between the concentration of auxins that is required for the growth of stem and root and the rate of growth. **Through your study, determine** which curve represents the root and which one represents the stem. **Giving reason.**





**Why** do you think, the nerve structure looks like the electric wires and cables ?

Chapter 5

Lesson Two

# Sensation in Man (Nervous Tissue)

## Nervous system

- **The nervous system cooperates with the endocrine system to :**
  - **Control** all the functions and activities of the human body systems and coordinate their actions accurately.
  - **Receive** the information of either external or internal stimuli through the receptor systems, then give the proper response to them.

  **This is for :**
  - **Keeping** the human body in a continuous and direct communication with its external and internal environments.
  - **Keeping** the internal environment of the body ideal, constant and balanced (homeostasis).
- The nervous system reaches the highest degree of development in vertebrates, especially in **man**.

**The nervous system is divided into :**

1. **Central nervous system (CNS)**
2. **Peripheral nervous system (PNS) :**
   - includes **Autonomic nervous system**
     - divided into
       - **Sympathetic** nervous system
       - **Parasympathetic** nervous system

Answered

## 1 Test yourself

**Choose the correct answer :**

Which of the following body systems can control the digestion process ?

(a) Muscular system only.
(b) Nervous system only.
(c) Endocrine system only.
(d) Nervous system and endocrine system.

- Before studying the structure of nervous system in detail, we should first study the building unit of the nervous system which is **"the nerve cell"**.

## Nerve cell (Neuron)

- Nerve cell is small in size like the other cells and can't be recognized by the naked eye.

**Nerve cell consists of**

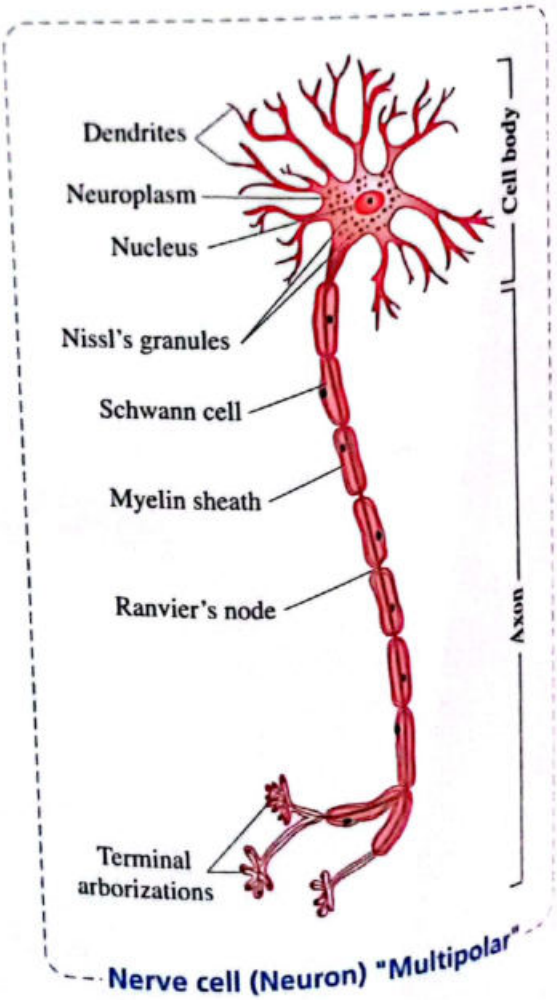
1. **Nerve cell body**
2. **Nerve cell processes**

### 1 Nerve cell body

- **Nerve cell body contains :**
  - Rounded nucleus.
  - Cytoplasm surrounds the nucleus and known as neuroplasm which contains :
    - All cell organelles, such as mitochondria and Golgi bodies, except the centrosome or centrioles. **So, neurons can't divide.**
    - Minute filaments called neurofilaments.
    - Minute granules called Nissl's granules.

### Nissl's granules

They are minute granules that are unique for (found in) nerve cells only and considered to be the stored food for the nerve cell which is consumed during its activity.




Nerve cell (Neuron) "Multipolar"

## 2 Nerve cell processes

- **There are two types of them in the nerve cell, which are :**

### A Dendrites

- Many short processes arise from the nerve cell body to increase the nervous surface area that receives the nerve impulses.
- Most of the nerve impulses enter the nerve cell body through the dendrites, and some of them enter through the cell body.

### B Axon (Nerve fiber)

- It is a long cytoplasmic extension of the cell body which may reach more than 1 meter in length.
- It ends with a group of branches called "terminal arborizations".
- **It is surrounded by two sheaths, which are :**

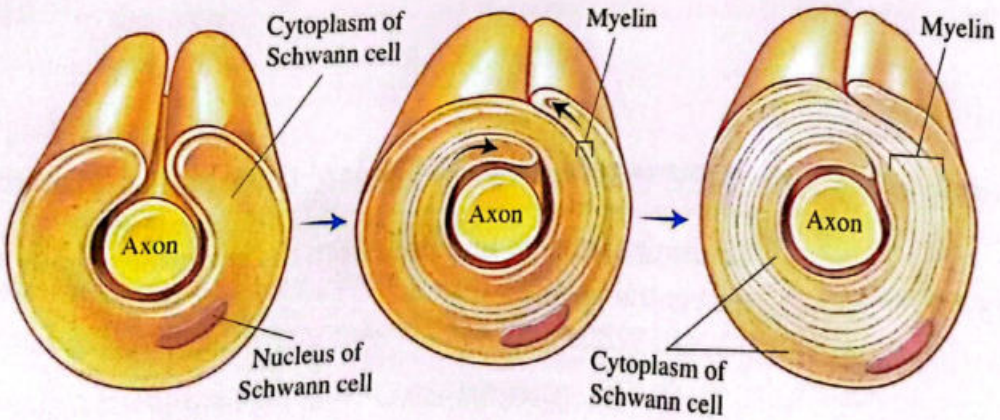
#### 1 Myelin sheath

- A white lipid substance called "**Myelin**" which is present in some nerve cells and secreted by special cells called "Schwann cells".
- It is not surrounding the axon continuously, but it is interrupted at certain points by a number of nodes called "Ranvier's nodes".

#### 2 Neurolemma

- A thin layer that covers the myelin sheath from outside.

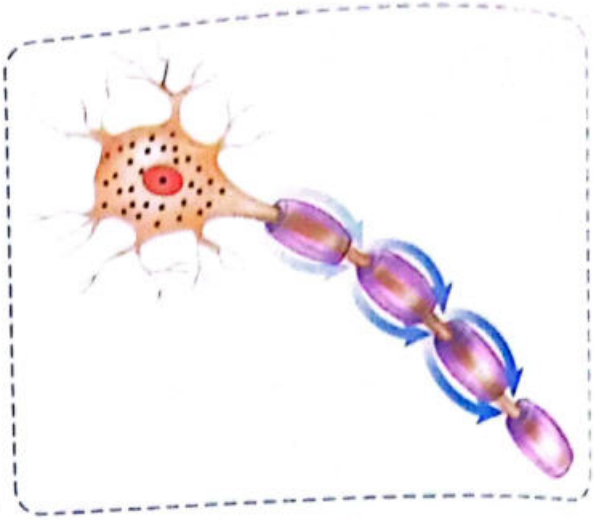
**Do you know... ?**




- These figures show how Schwann cells form the myelin substance around the neuron's axon, where the Schwann cell wrapped around the neuron's axon several times until the axon is surrounded by several layers of lipid myelin substance and the presence of the cell cytoplasm and its nucleus are limited at its tip.

### Function of the axon

It transfers the nerve impulses from the body of the nerve cell to the synapse, and it was found that the myelinated axons (covered by the myelin sheath) transfer these nerve impulses much more rapidly than the non-myelinated nerve fibers (axons), this is because the myelin sheath is considered an insulating material, that makes the nerve impulse move through Ranvier's nodes only.



**Note**

The nerve impulse is always propagating and conducting in one direction only, as the nerve impulses enter the nerve cell body through the dendrites, then to the axon, while the terminal arborizations transmit these impulses away from the cell body through the synapse.

## Test yourself

Answered

**1 Choose the correct answer :**

Which of the following is correct about the nerve cell ?

(a) It contains centrosome.
(b) It has the ability to divide.
(c) It contains nucleus.
(d) It doesn't contain mitochondria.

**2 What happens if :** a person suffers from an immune disease that causes the destruction of myelin sheath of the nerve cells ? **Explain your answer.**

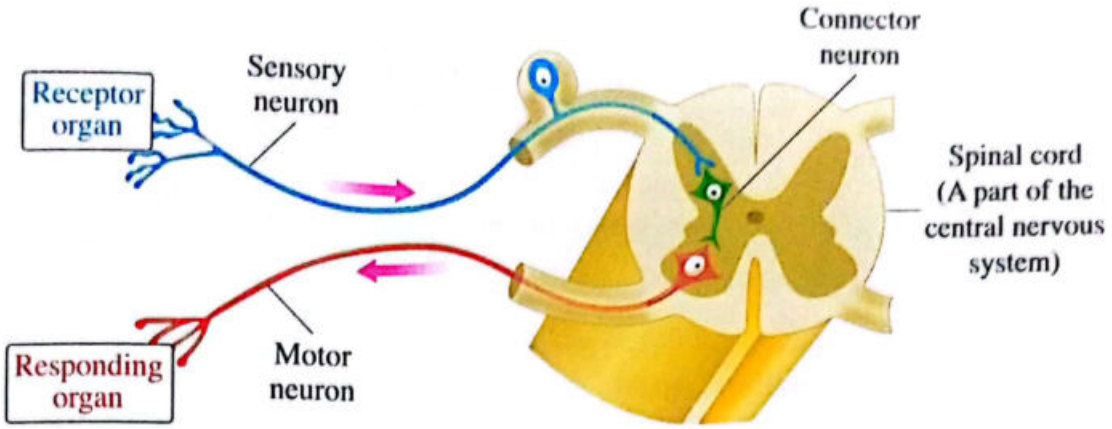
.....

.....

## Types of nerve cells

- **According to the function, nerve cells are classified into three main types, which are :**

1. **Sensory neurons :** Transmit the nerve impulses from the **receptor organs** to the central nervous system.
2. **Motor neurons :** Transmit the nerve impulses from the central nervous system to the **effector (responding) organs**, such as muscles and glands.
3. **Connector (Intermediate) neurons "Interneurons" :** Connect the sensory neurons with the motor neurons (act as a link between them).




Types of nerve cells

## Test yourself

Answered

**Choose the correct answer :**

Which of the following choices represents the connection between the nerve cells' parts in the central nervous system ?

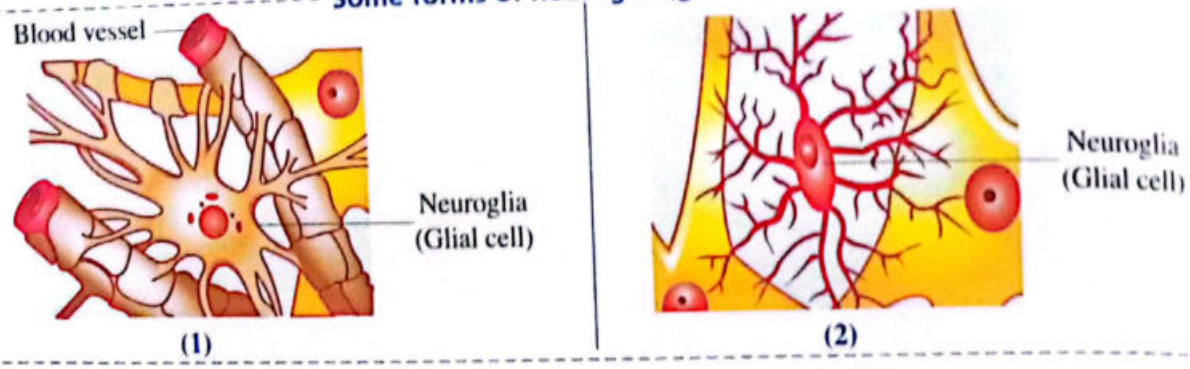
| | Terminal arborizations of cells | Dendrites of cells |
|---|---|---|
| ⓐ | Motor | Connector |
| ⓑ | Connector | Motor |
| ⓒ | Motor | Sensory |
| ⓓ | Connector | Sensory |

- In addition to the nerve cell's bodies and their processes, there is another type of cells in the nervous tissue which is known as **"neuroglia"**.

### Neuroglia (Glial cells)

- A type of cells that are found among the components of nervous tissue which are characterized by their ability to divide.
- **The main functions of neuroglia :**
  1. Support the neurons, where they act as a connective tissue **(Supportive)**.
  2. Act as insulators among the neurons **(Insulator)**.
  3. Nourish the neurons **(Nutritive)**.
  4. Have a role in repairing the injured parts of some neurons **(Compensator, because they can divide)**.
  5. Connect the nerve fibers (axons with surrounding sheaths) together to form the nerve bundle which form the nerve **(Connective)**.

Some forms of neuroglia (glial cells)




## 4 Test yourself

Answered

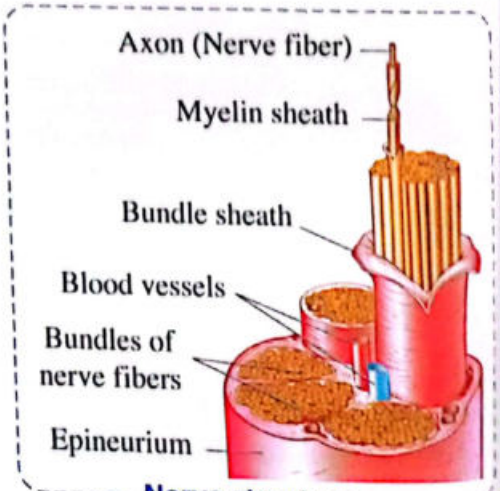
**Choose the correct answer :**

Schwann cells are considered a special type of neuroglia and contribute in the speed of the nerve impulse transmission, what is the property that characterizes these cells ?

(a) They have the ability to divide.
(b) They act as a connective tissue.
(c) They nourish the nerve cells.
(d) They form the myelin substance.

## Nerve

- **Nerve consists of :**
  - **A group of nerve bundles :**
    Each nerve bundle is formed of a group of nerve fibers (axons with surrounding sheaths) and connected by supporting neuroglia (glial cells).
  - **Bundle sheath :**
    It is a connective tissue that surrounds each nerve bundle.
  - **Nerve sheath (Epineurium) :**
    It is a connective tissue that surrounds the whole nerve (groups of nerve bundles) and contains blood vessels.




Nerve structure

Nerve → consists of → Nerve bundles → each bundle consists of → Nerve fibers (Axons + Sheaths)

## 5 Test yourself

**Choose the correct answer :**

Which of the following statements **isn't** correct about the nerve bundle ?

(a) The nerve cells' axons participate in its formation.
(b) It is surrounded by the same type of tissue that surrounds the nerve.
(c) Its diameter is greater than that of epineurium.
(d) Its length may reach one meter.

Chapter 5

Questions on Lesson Two

# Sensation in Man (Nervous Tissue)

Use the App GPS

The questions signed by ✳ are answered in detail. ● Understand ● Apply ● Analyze

Interactive test

## First Multiple Choice Questions

1 When a person exerts a muscular effort, the heartbeats rate, respiration rate and sweat secretion increase. Which of the following systems regulates the actions among the previous organs in the human body ?

(a) Circulatory. (b) Nervous. (c) Excretory. (d) Respiration.

2 Which of the following is considered the functional unit of the nervous system ?

(a) Nerve cell. (b) Glial cell.
(c) Schwann cell. (d) Nerve.

3 Which of the following statements is correct ?

(a) The nerve cell is surrounded by one Schwann cell.
(b) Schwann cell is surrounded by one nerve cell.
(c) The nerve cell is surrounded by more than one Schwann cell.
(d) Schwann cell is surrounded by more than one nerve cell.

4 Which of the following their presence is associated with receiving the nerve impulses in the nerve cell ?

(a) The cell body and terminal arborizations. (b) The dendrites and terminal arborizations.
(c) The cell body and dendrites. (d) The cell axon and terminal arborizations.

5 During the dissection of a human body, a structure in the nervous system whose length is more than 95 cm was found, which of the following may represent this extension ?

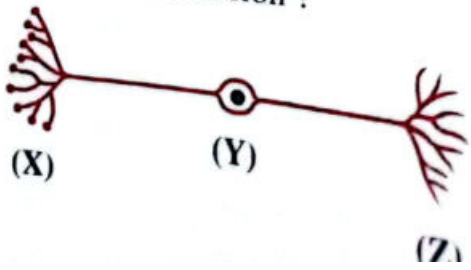
(a) A nerve cell body. (b) An axon of nerve cell.
(c) A glial cell. (d) A dendrite of nerve cell.

6 Which of the following is correct about the nerve cells characteristics ?

(a) They can divide.
(b) They contain Nissl's granules during their activity.
(c) They always contain Ranvier's nodes.
(d) Some of them can compensate the cut parts from their axons.

7 In the following figure, what is the direction of the nerve impulse transmission ?

(a) From (X) to (Y), then to (Z).
(b) From (Z) to (Y), then to (X).
(c) From (Y) to (Z), and from (Y) to (X).
(d) From (Z) to (Y), and from (X) to (Y).



**8** Some parts of the nervous system are characterized by having white colour, which of the following components of the neuron whose presence is limited only in the white coloured regions ?

(a) Neuroplasm. (b) Schwann cells.

(c) Dendrites. (d) Nissl's granules.

---

**9** Which of the following is correct about the nerve cell ?

(a) The dendrites are different from the terminal arborizations of the nerve cell.

(b) The myelin sheath consists of nerve cells.

(c) The nerve cell nuclues can divide.

(d) The transmission of the nerve impulse takes place through the myelin sheath.

---

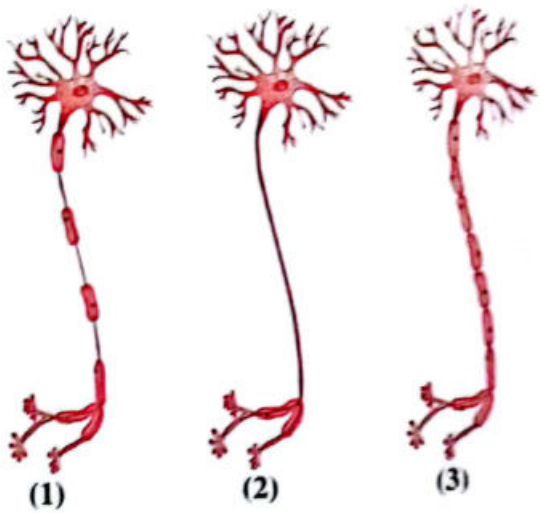
**10** The opposite figures illustrate three nerve cells having the same length of axon, which of the following choices represents the arrangement of these cells from the slower to the faster in transmitting the nerve impulse ?

(a) (2), (3) then (1).

(b) (1), (2) then (3).

(c) (3), (1) then (2).

(d) (2), (1) then (3).

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**11** What are the cells that transmit the nerve impulse from the peripheral nervous system to the central nervous system ?

(a) Sensory neurons. (b) Motor neurons. (c) Connector neurons. (d) Neuroglia.

---

**12** Which of the following can the sensory neurons link between them ?

(a) The brain with muscles. (b) The sense organs with muscles.

(c) A sense organ with another sense organ. (d) The sense organs with brain.

---

**13** Which of the following represents the route of transmitting the nerve impulse from a nerve cell to another one ?

(a) Dendrites ⟶ Terminal arborizations.

(b) Dendrites ⟶ Dendrites.

(c) Terminal arborizations ⟶ Terminal arborizations.

(d) Terminal arborizations ⟶ Dendrites.

**14** What is the role of neuroglia which are found between the nerve cells and blood capillaries ?

ⓐ Supporting. ⓑ Nutrition. ⓒ Compensation. ⓓ Connection.

**15** Which of the following is correct about neuroglia ?

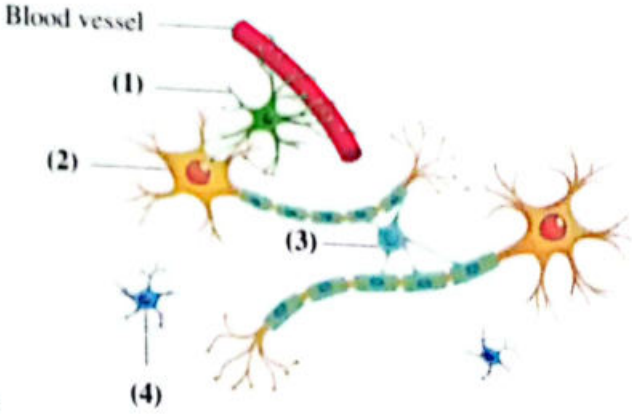
ⓐ They represent a type of nerve cells.

ⓑ They transmit the nerve impulse.

ⓒ They are considered from the components of nervous tissue.

ⓓ They have no ability to divide.

**16** Study the opposite figure, then deduce :




**(1)** Which of the following cells links between the cells of this tissue ?

ⓐ (1).

ⓑ (2).

ⓒ (3).

ⓓ (4).

**(2)** Which of the following cells nourishes the cells of this tissue ?

ⓐ (1). ⓑ (2). ⓒ (3). ⓓ (4).

**17** Which of the following are nourishing the nerve cells ?

ⓐ Nissl's granules and neurolemma. ⓑ Neuroglia and mitochondria.

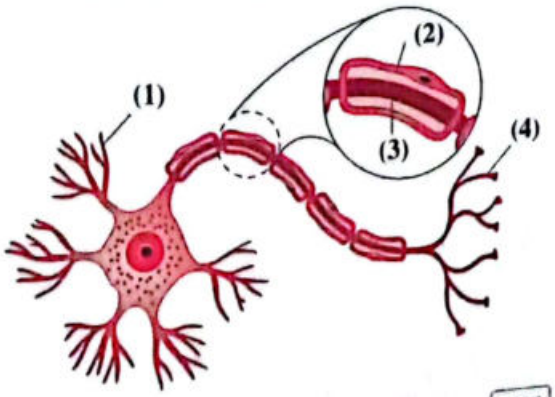
ⓒ Nissl's granules and neuroglia. ⓓ Mitochondria and neurolemma.

**18** What does the nerve represent ?

ⓐ A dendrite of a neuron. ⓑ Uncoated cylindrical axons.

ⓒ A group of coated nerve fibers. ⓓ A group of nerve cell bodies.

**19** * Which of the following structures its absence decreases the speed of the nerve impulse transmission through the opposite nerve cell ?




ⓐ (1).

ⓑ (2).

ⓒ (3).

ⓓ (4).

**20** ❋ Which of the following do you expect to be absent after the neuron exerts a high activity ?

ⓐ Neuroplasm. ⓑ Mitochondria.

ⓒ Nissl's granules. ⓓ Golgi bodies.

---

**21** ❋ What is the part of the nerve cell which transmits the nerve impulse away from the cell body ?

ⓐ Schwann cell. ⓑ Dendrite.

ⓒ Terminal arborization. ⓓ Synaptic knob.

---

**22** ❋ Multiple sclerosis is an autoimmune disease that affects the nervous system, whereas the immune system destroys Schwann cells, what does this disease cause ?

ⓐ An increase in the speed of the nerve impulse transmission.

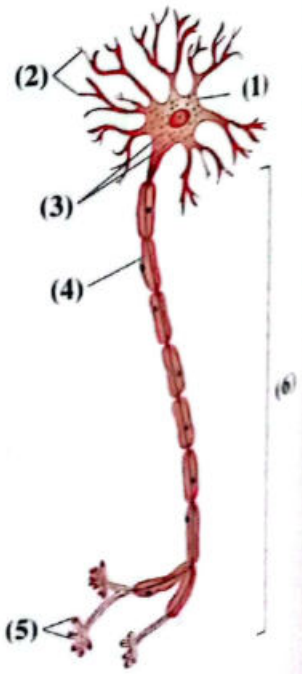
ⓑ The stopping of the nerve impulse transmission.

ⓒ Non-division of the nerve cells.

ⓓ A decrease in the speed of the nerve impulse transmission.

## Second Miscellaneous Questions

**1 In the opposite figure :**




**(a) What** is the function of the two structures no. (3) and (4) ?

**(b) What** are the cellular organelles that are not present in structure no. (1) ?

**(c) What** is the difference between the two structures no. (2) and (5) ?

**(d) Determine** the direction of the nerve impulse transmission in structure no. (6). **Giving reason.**

2 **What is the relation between :** Schwann cells and the speed of the nerve impulse transmission ?

3 **Compare between :** sensory neurons and motor neurons.

4 "The different types of nerve cells transmit different types of nerve impulses". **How far is this statement correct ? With explanation.**

5 **What happens in case of :** the absence of neuroglia from the components of the nervous tissue ?

6 **Give reason for :** on the occurrence of an injury in the nervous centres, the wound can be healed, although the neurons are unable to divide.

7 **Compare between :** nerve cells and neuroglia, "**according to :** function – division".

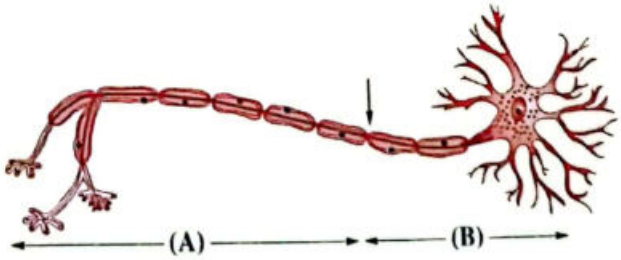
8 **Explain :** the role of each of the connector neuron and glial cell is different in performing the function of connection.

## Questions that measure **high levels of thinking**

Answered in detail

**Choose the correct answer :**

1 From the following figure, if a cut is occurred to the axon of a nerve cell at the arrow position, what do you expect to happen ?



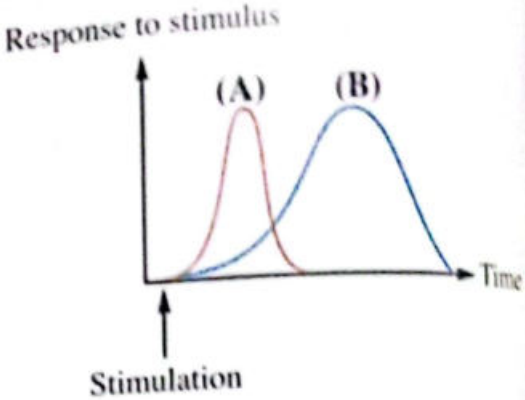

(a) The nerve cell will die.

(b) Parts (A) and (B) will be regenerated separately to produce two new nerve cells.

(c) Part (A) will degenerate, and it will be regenerated by part (B).

(d) Part (B) will degenerate, and it will be regenerated by part (A).

**2** The opposite graph illustrates the speed of the nerve impulse transmission through two axons of two nerve cells that were exposed to the same stimulus, which of the following can be concluded ?




(a) Curve (A) represents a myelinated axon, and curve (B) represents a non-myelinated axon.

(b) Curve (B) represents a myelinated axon, and curve (A) represents a non-myelinated axon.

(c) Curve (A) represents an axon of sensory neuron, and curve (B) represents an axon of motor neuron.

(d) Curve (B) represents an axon of sensory neuron, and curve (A) represents an axon of motor neuron.

---

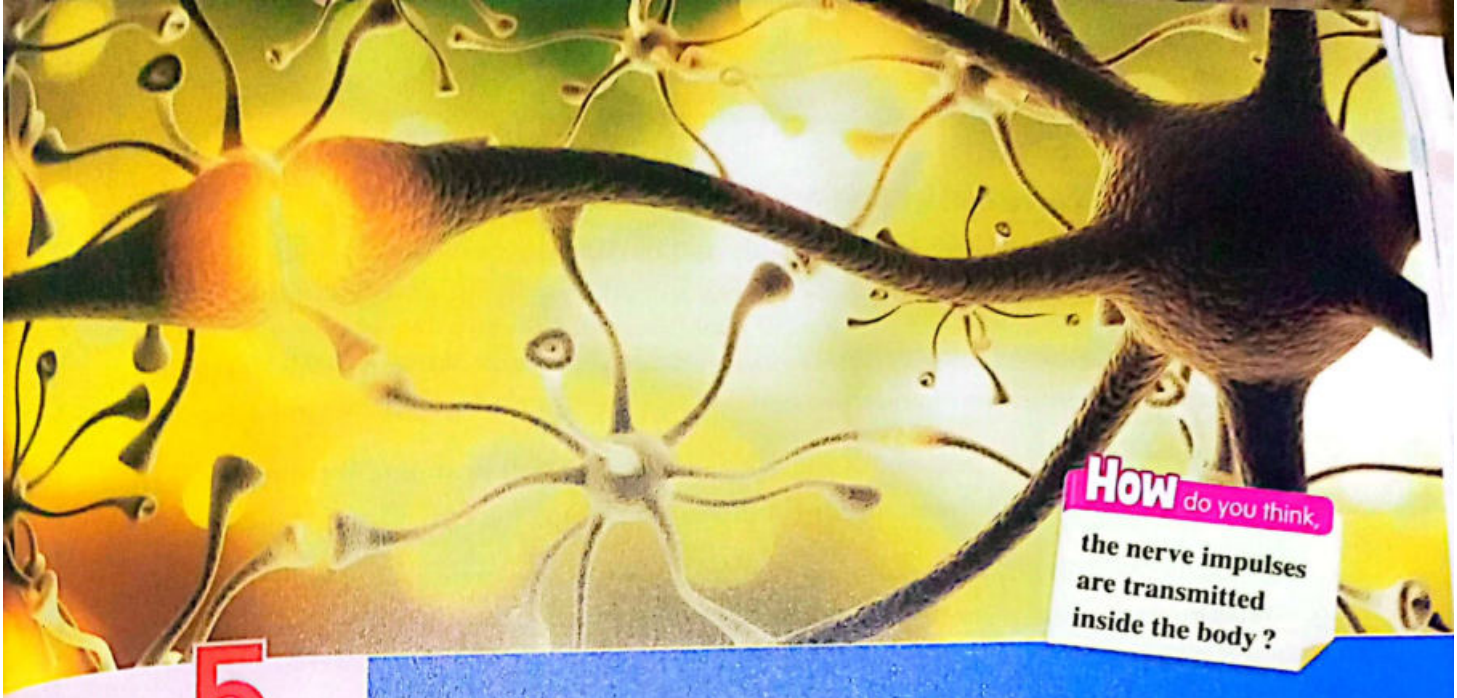
**3** If the diameter of the membrane of nerve bundle (X) in a region in the body equals the diameter of the nerve sheath (Y) in another region, which of the following would explain that ?

(a) The nerve axons in (X) are coated by myelin substance.

(b) The nerve axons in (Y) are coated by myelin substance.

(c) The absence of the connective tissue from the nerve sheath (X).

(d) The presence of more glial cells in (Y).




Chapter 5

Lesson Three

# Nerve Impulse

## Nerve impulse

### Nerve impulse

It is the message that is transmitted through the nerves from the sense organs (receptors) to the central nervous system (brain and spinal cord), and from it to the effector (responding) organs (muscles and glands).

### Nature of the nerve impulse

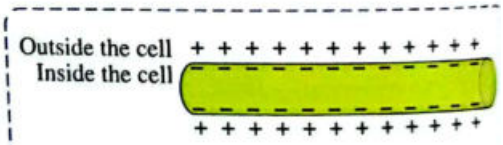
- The nature of the nerve impulse transmission is an **electrical phenomenon** with **chemical nature (electrochemical phenomenon)**, to understand the nature of the nerve impulse and its transmission in the nerve fiber, we have to study the nerve cell and the changes that occur to it **during the following four states :**

**State**

- **First** The nerve cell at rest.
- **Second** The changes that occur when stimulating the nerve cell.
- **Third** The propagation of the nerve impulse through nerve fibers.
- **Fourth** The return of nerve cell to its original state.

## First state Nerve cell at rest

- On studying the ions concentration inside and outside the nerve cell, it was found that there is a clear difference in the distribution and concentration of these ions, where :
  - The concentration of sodium ions ($Na^+$) outside the cell is about **10 : 15** times higher than their concentration inside the cell.
  - The concentration of potassium ions ($K^+$) inside the cell is about **30 times** higher than their concentration in the external fluid that surrounds the cell.
  - The concentration of negative ions inside the cell is much higher than their concentration outside, due to the presence of chloride ions ($Cl^-$) and negatively charged protein molecules.
  - The amount of negative ions that are present inside the nerve cell is equivalent to all positive ions and exceeds them. So, the inner surface of the cell is negatively charged.
  - The amount of positive ions that are present outside the nerve cell is equivalent to all negative ions and exceeds them. So, the outer surface of the cell is positively charged.
- The unequal distribution of ions outside and inside the nerve cell results in the presence of an **electrical potential difference** that is called "resting potential" and equals (**–70** millivolt (**mV**)), resulting in the "**polarization state**".



The nerve fiber membrane at polarization state

### Polarization

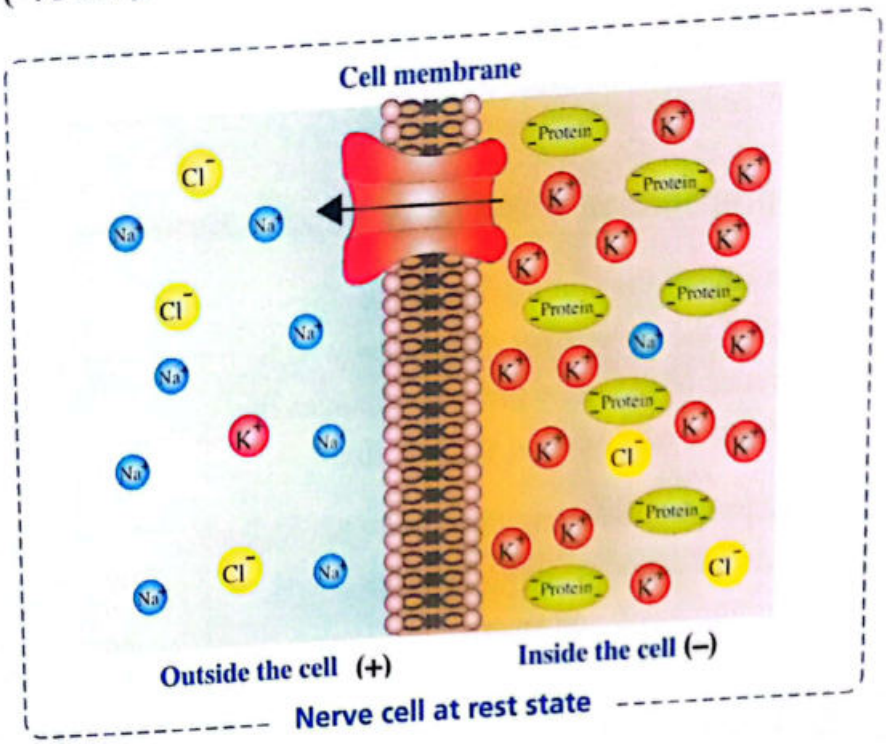
It is the nerve cell state at rest, when its outer surface is positively charged and its inner surface is negatively charged.

- **The reasons for the occurrence of polarization state in the nerve cell :**

1. **The unequal selective permeability for sodium and potassium ions :**
   - The nerve cell membrane during rest is **40 times** permeable to potassium ions ($K^+$) (which diffuse from inside to outside) than its permeability to sodium ions ($Na^+$) (which diffuse from outside to inside).
   - This results in the accumulation of excess positive charges on the outer surface of the membrane.
2. **The accumulation of ionized proteins with high molecular weight :**
   They are negatively charged on the inner surface of the nerve cell membrane, in addition to chloride ions ($Cl^-$).
3. **Sodium-potassium pumps that are present in the fiber membrane :**
   - They play a role in maintaining the relative ionic distribution on the two sides of

fiber membrane by active transport, till the occurrence of stimulation and passage of nerve impulse.

- The accumulation of positive potassium ions outside the membrane, leaving the negative proteins (which can't pass through the membrane, due to their large size), while chloride ions ($Cl^-$) are in its inner side. So, the cell potential difference at rest reaches **(–70 mV)**.



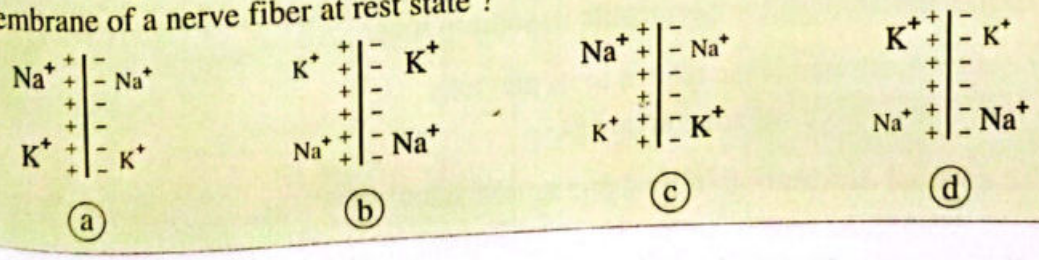
Nerve cell at rest state

Answered

## Test yourself

**Choose the correct answer :**

If the large-sized symbol of ion expresses the higher concentration, while the small-sized symbol of ion expresses the lower concentration, which of the following figures represents the membrane of a nerve fiber at rest state ?




## Second state The changes that occur when stimulating the nerve cell

1. The nerve cell is stimulated only, when the stimulus is sufficient for stimulating it.
2. There are changes that occur in the permeability of cell membrane to ions, leading to :
   - The inflow of large amounts of sodium ions ($Na^+$) to inside the cell.
   - The outflow of small amounts of potassium ions ($K^+$) to outside the cell.

   This occurs through special channels or paths in the cell membrane, where the amount

of positive charges that enter the cell is enough to neutralize the negative ions inside it, **i.e.** the outer surface becomes negatively charged comparing with its inside, and this is the reverse to the resting state.

3. The membrane potential difference becomes about (+40 mV), and this new state is called "**depolarization state**".

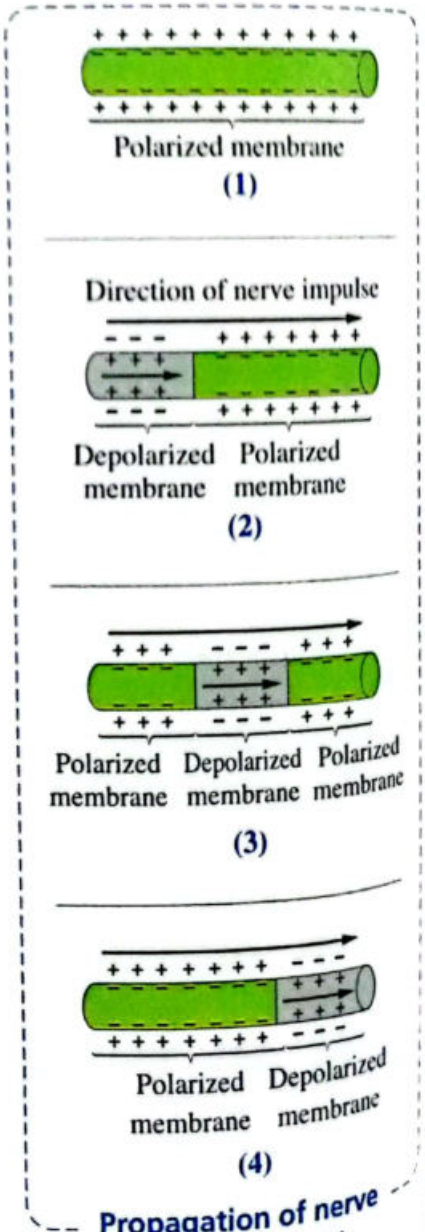
### Depolarization

It is the nerve cell state on stimulation, when its outer surface is negatively charged and its inner surface is positively charged.

## Third state The propagation of the nerve impulse through nerve fibers

1. The depolarization causes the stimulation of the neighbouring point of the nerve fiber membrane which leads to the occurrence of the same previous changes that occur on stimulating the nerve cell at the first time.

2. The nerve impulse propagated along the nerve fiber in the form of waves of depolarization, polarization and then depolarization again and so on.




**Propagation of nerve impulse through the nerve fiber**

## Fourth state The return of nerve cell to its original state (Repolarization)

- **As soon as the stimulus effect vanishes, changes occur in the nerve fiber membrane, as follows :**

1. The nerve fiber membrane becomes permeable again to potassium ions and impermeable to sodium ions.
2. The nerve fiber membrane returns to its previous permeability before stimulation (at rest).
3. The unequal distribution of ions on the two sides of the membrane returns to its original (resting) state, **i.e.** it returns to the polarization state "**repolarization**".
4. The membrane of nerve cell restores its physiological properties through the refractory period to be ready to respond to a new stimulus and transmit another nerve impulse.

## Refractory period

It is a short period of time (0.001 : 0.003 of second) that follows the nerve stimulation in which the nerve cell membrane restores its physiological properties (its selective permeability) "through $Na^+$- $K^+$ pump" to be ready for responding to a new stimulus and transmitting another nerve impulse, and during this period the nerve cell will not respond to any stimulus whatever its strength.

5 The response of nerve cell to the stimulus is called the "action potential" which includes a state of depolarization followed by repolarization, and it equals (**110 mV**).

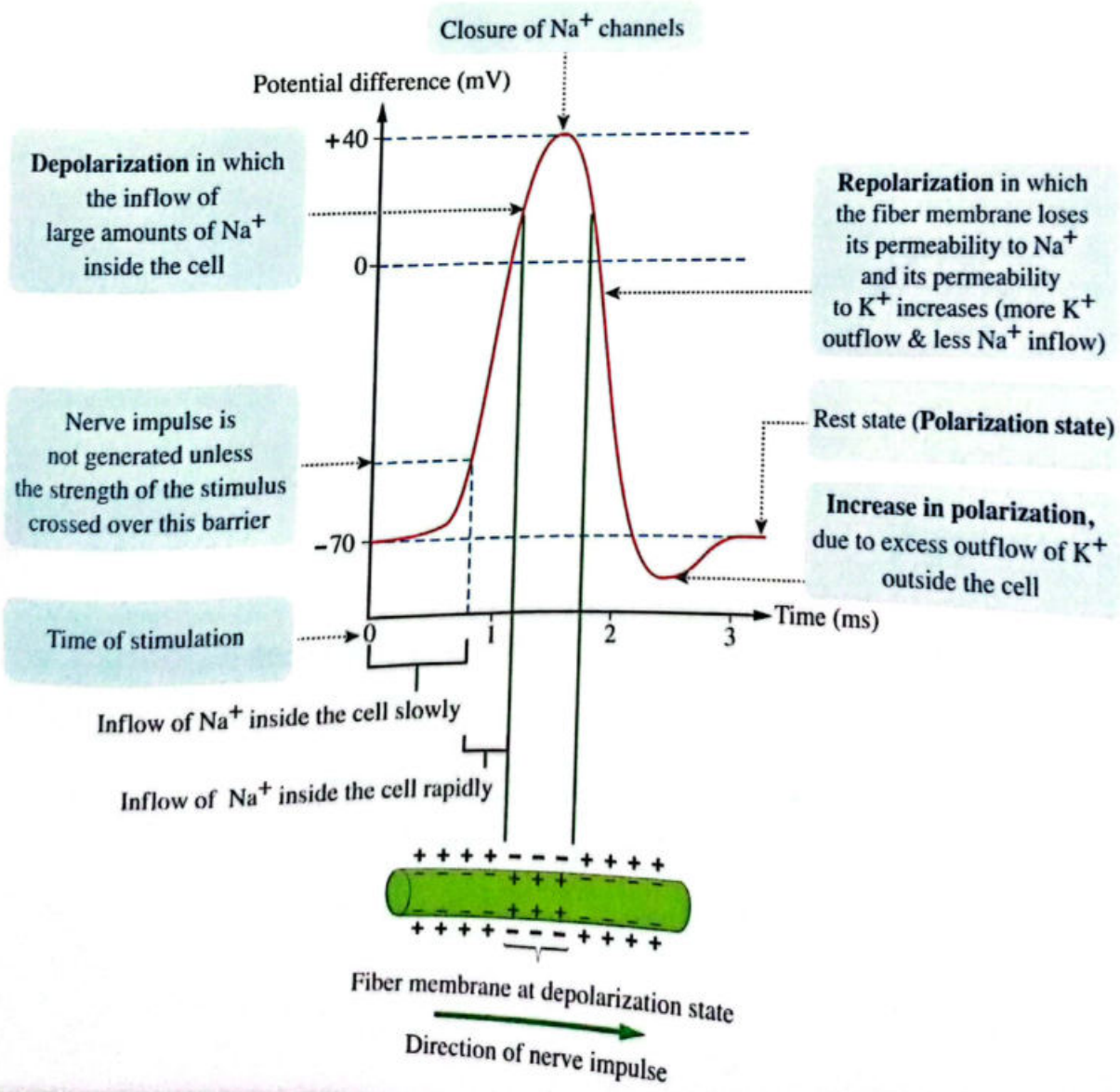
## Action potential

It is a phenomenon of depolarization (from – 70 mV to + 40 mV), and it equals (110 mV).

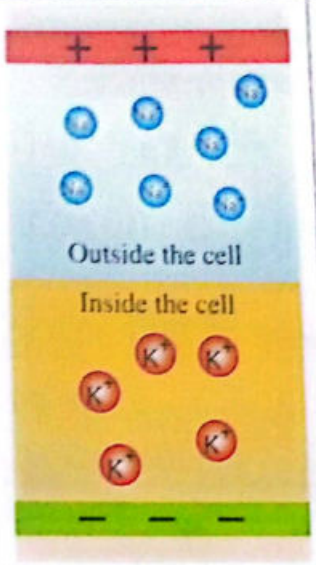
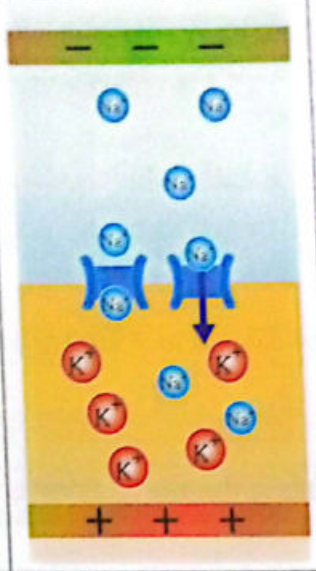
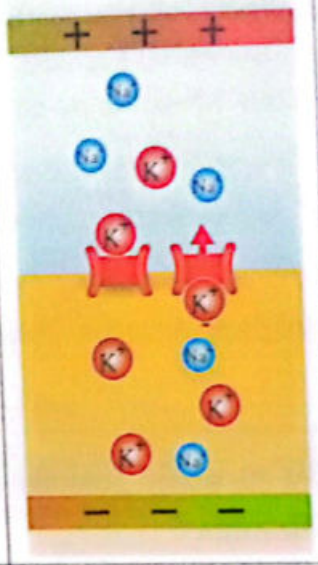
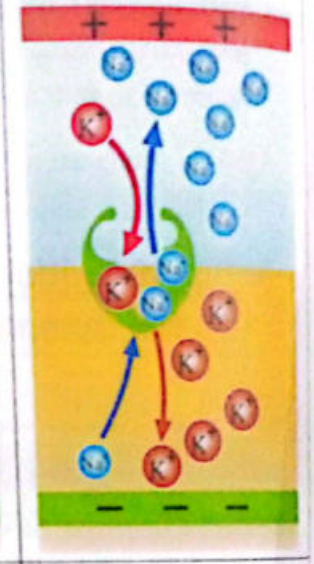
**Note**

The rapid propagation of the action potential along the nerve fiber is in fact **the nerve impulse** or **stimulus**.

• **Curve illustrates the changes that occur to a nerve cell that is exposed to a stimulus :**



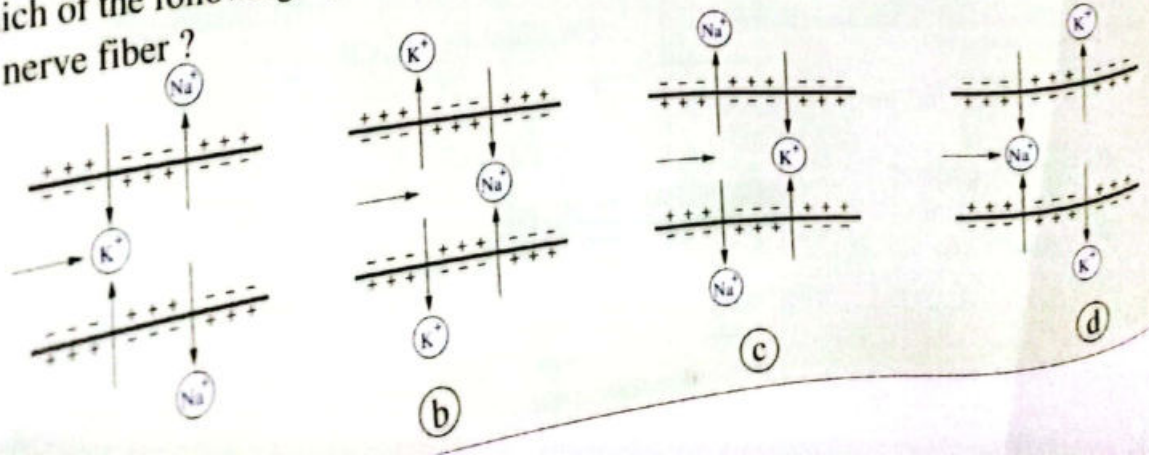
• From the previous, we can hold the following comparison :

| Polarization | Depolarization | Repolarization | Return to the rest state |
|---|---|---|---|
|   |  |  |  |
| The concentration of sodium ions outside the nerve cell is greater than that inside the nerve cell, while the concentration of potassium ions inside the nerve cell is greater than that outside the nerve cell. So, its membrane becomes positively charged outside and negatively charged inside the cell. | The inflow of large amounts of sodium ions ($Na^+$) to inside the nerve cell. So, its membrane becomes negatively charged outside and positively charged inside. | The membrane loses its permeability to sodium ions inside the nerve cell and increases its permeability to potassium ions outside the nerve cell. So, its membrane becomes positively charged outside and negatively charged inside the cell. | The membrane restores its physiological properties at rest state by active transport for sodium ions to outside the nerve cell and potassium ions to inside the nerve cell. |

## 2 Test yourself

**Choose the correct answer :**

Which of the following figures expresses the propagation of nerve impulse through the nerve fiber ?



## Properties of the nerve impulse

### 1 Speed of the nerve impulse

- The speed of the nerve impulse propagation from a place to another along the nerve fiber depends on the diameter of the nerve fiber, **as :**
  - The speed of nerve impulse propagation reaches about **140 m/s** in thick (myelinated) nerve fibers of **large diameter**.
  - The speed of nerve impulse propagation reaches about **12 m/s** in thin (non-myelinated) nerve fibers of **small diameter**.

### 2 All or None law

- The stimulation of nerve and muscles contraction obey the "All or None" law.

***All or None law***

- *The nerve impulse will not be generated, unless the stimulus is strong enough to stimulate the nerve with a maximal strength, **i.e.** the sufficient stimulus produces maximum response.*
- *Any increase in the stimulus strength will not increase the response strength.*
- *The weak stimulus is insufficient to change the nerve cell (or nerve fiber) from the rest state (–70 mV) to the action potential (110 mV), **i.e.** it can't produce an action potential (nerve impulse).*

### 3 *Test yourself*

Answered

**Choose the correct answer :**

What are the properties of nerve fiber membrane that transmits the nerve impulse rapidly ?

(a) Myelinated and has large diameter.
(b) Myelinated and has small diameter.
(c) Non-myelinated and has large diameter.
(d) Non-myelinated and has small diameter.

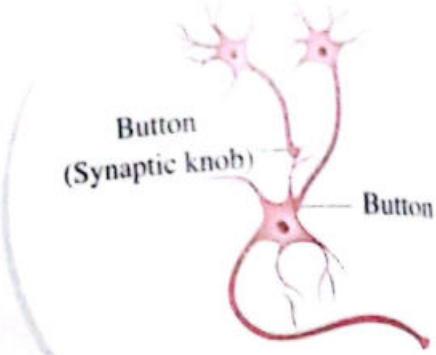
## Synapse

**Synapse**

It is the site that is present between the terminal branches (arborizations) of the axon of one neuron and the dendrites of the next neuron.

## Types of synapse

1. Synapse between two neurons.
2. Synapse between a neuron and a muscle fiber.
3. Synapse between a neuron and glandular cells.




Synapse between neurons

## Structure of the synapse

- **The ultrastructure of synapse reveals that the synapse consists of :**

### 1 Buttons (Synaptic knobs)

They are swellings that are present at the end of the terminal arborizations of a nerve cell axon and located very close to the dendrites (or cell body) of the next neuron.

### 2 Synaptic (Nervous) vesicles

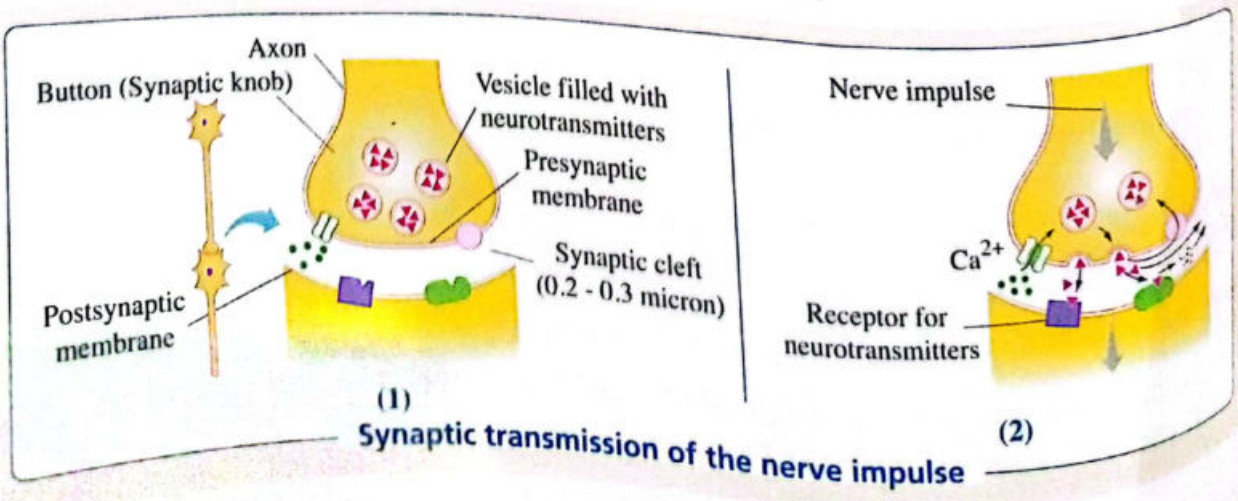
They are small sacs that are present inside the buttons and filled with chemical transmitters (neurotransmitters), such as acetylcholine and noradrenaline (neurotransmitter hormone) which play an important role in the transmission of the nerve impulse from a neuron to the next one through the synapse.

### 3 Synaptic cleft

It is a narrow space that is present between the buttons and dendrites of the next neuron, and separates the presynaptic membrane (terminal arborizations) from the postsynaptic membrane (dendrites).

## Mechanism of transmitting the nerve impulse across the synapse

- **The study of the synapse is important in explaining how the nerve impulse is transmitted from a nerve cell to another, as follows :**




Synaptic transmission of the nerve impulse

1. The arrival of a nerve impulse to the **buttons "synaptic knobs"** leads to the entry of calcium ions inside the cell by the action of calcium pump that is present in the nerve cell membrane.
2. The inflow of calcium ions leads to the rupture of a large number of synaptic vesicles and the release of **neurotransmitters** from them.
3. The **neurotransmitters** cross the **synaptic cleft** and reach the membrane of dendrites of the next neuron.
4. The **neurotransmitters** bind to their special receptors that are present on the membrane of dendrites, leading to the stimulation of these points and changing the permeability of the membrane to sodium ($Na^+$) and potassium ($K^+$) ions.
5. This results in depolarization and production of an action potential (nerve impulse) which is propagated from the nerve cell body to its axon, then to the next neuron and so on.
6. After performing its function, acetylcholine (neurotransmitter) is destroyed under the effect of an enzyme called cholinesterase to terminate its action. Therefore, the postsynaptic membrane returns to the resting (polarization) state again.

## Key Point

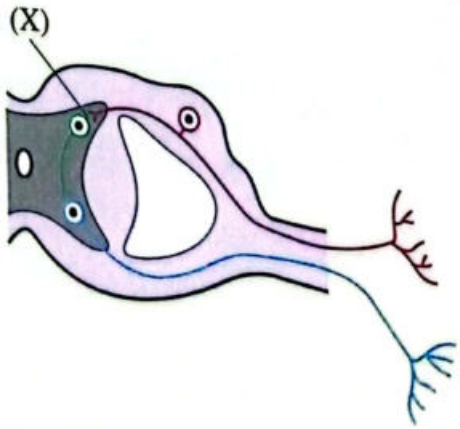
When the terminal arborizations of an axon of nerve cell connect to the dendrites of more than one neighbouring neuron, the nerve impulse that passes through this axon to the neighbouring neurons transmits by the same strength and response for the occurrence of the chemical changes in the synapses with these cells.

## Test yourself

Answered

**1 Choose the correct answer :**

In the opposite figure, what is the type of synapse in letter (X) ?

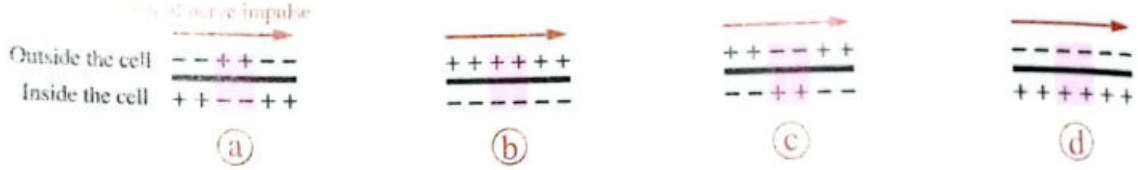



(a) Between neurons (sensory neuron - connector neuron).
(b) Between neurons (motor neuron - connector neuron).
(c) Between a neuron and a muscle fiber.
(d) Between a neuron and a glandular cell.

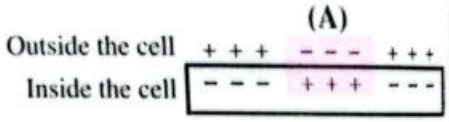
**2 What happens in case of :** the absence of calcium ions from the synaptic region ?

## First Multiple Choice Questions

1 Which of the following figures the shaded part in it represents the state of nerve fiber membrane when transmitting the nerve impulse from the rest state ?

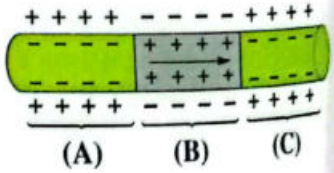



2 From the opposite figure, which of the following agrees with the change in the membrane state as shown in region (A) ?




(a) Outflow of small amount of ($K^+$).
(b) Outflow of large amount of ($Na^+$).
(c) Changing the potential difference to – 70 mV.
(d) Repolarization.

3 From the opposite figure :

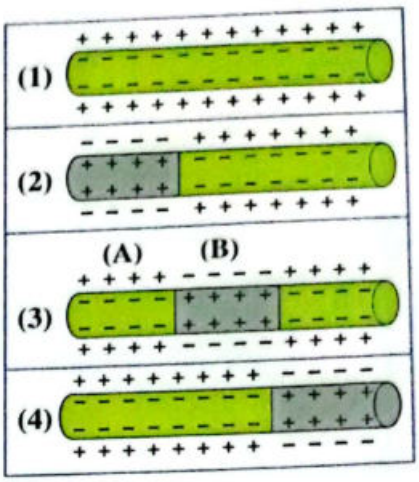



**(1)** What are the states of the nerve fiber membrane at the two regions (B) and (C) respectively ?
(a) Polarization / Depolarization.
(b) Repolarization / Depolarization.
(c) Depolarization / Polarization.
(d) Depolarization / Repolarization.

**(2)** What happens to the permeability of the nerve fiber membrane at region (A) to outside ?
(a) Increases to ($K^+$) and decreases to ($Na^+$).
(b) Increases to ($Na^+$) and decreases to ($K^+$).
(c) Increases to each of ($Na^+$) and ($K^+$).
(d) Decreases to each of ($Na^+$) and ($K^+$).

4 Which of the following causes the change in the potential difference on the two sides of the nerve fiber membrane after stimulation to reach (+40 mV) ?
(a) The inflow of ($Na^+$).
(b) The inflow of ($K^+$).
(c) The inflow of ($K^+$) and the outflow of ($Na^+$).
(d) The outflow of ($K^+$) and ($Na^+$).

**5** The opposite figure illustrates the membrane of nerve fiber during different stages :




**(1)** Which of these stages represents the nerve cell at rest state ?

ⓐ (1). ⓑ (2).

ⓒ (3). ⓓ (4).

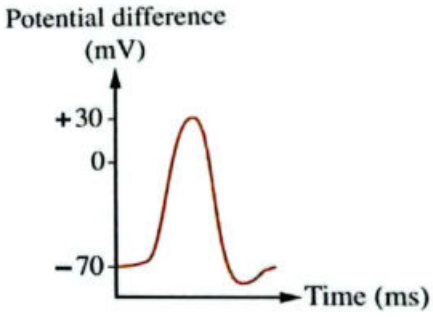
**(2)** What is the value of the electrical potential difference in millivolt between the two sides of the nerve cell membrane in the two regions (A) and (B) respectively ?

ⓐ – 70 / + 40 ⓑ + 40 / 110

ⓒ + 40 / – 70 ⓓ 110 / + 40

---

**6** The opposite graph illustrates a nerve cell that is exposed to a stimulus, what is the value of the action potential of this cell ?




ⓐ + 90 mV.

ⓑ + 100 mV.

ⓒ + 110 mV.

ⓓ + 120 mV.

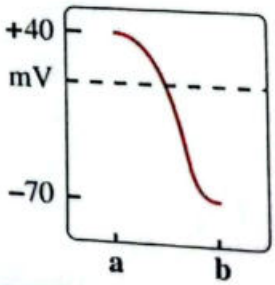
---

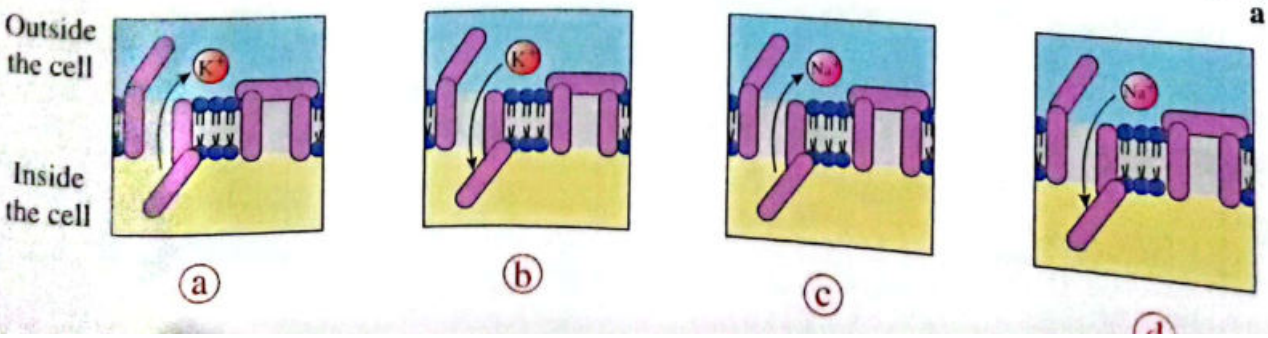
**7** Which of the following ions the increase in its permeability causes the return of the potential difference in the nerve cell to (–70 mV) after stimulation ?

ⓐ $Na^+$ ⓑ $K^+$ ⓒ $Ca^{++}$ ⓓ $Cl^-$

---

**8** Which of the following figures represents the flow of a larger amount of ions during the period (ab) of the nerve impulse in the opposite curve ?



9 Which of the following parts of the nerve fiber through which the potential difference of nerve cell can be measured ?

(a) Myelin sheath. (b) Ranvier's nodes.

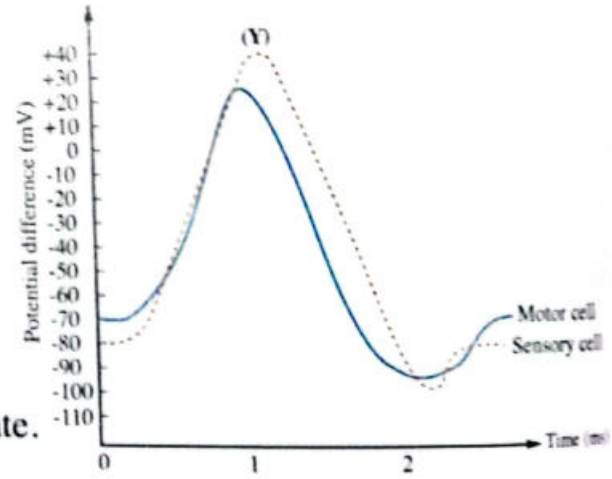
(c) Nerve membrane. (d) Schwann cell.

10 Which of the following whose concentration isn't affected during the transmission of nerve impulses in the axon of a nerve cell till its terminal arborizations ?

(a) Potasium ions. (b) Protein molecules.

(c) Sodium ions. (d) Calcium ions.

11 The opposite graph represents two nerve cells, one of them is sensory and the other is motor in the same living organism, and each of them is at a stimulation state :




**(1)** Which of the following statements is correct on time (0) ?

(a) The motor cell only is at rest state.

(b) The sensory cell only is at polarization state.

(c) Both cells are at rest state.

(d) The sensory nerve cell is at repolarization state.

**(2)** Which of the following is the reason for the change in the potential difference of the sensory neuron membrane at time period (0 : 1) ?

(a) The inflow of $(Na^+)$. (b) The inflow of $(K^+)$.

(c) The outflow of $(Cl^-)$. (d) The outflow of $(K^+)$ and $(Cl^-)$.

**(3)** What happens at point (Y) ?

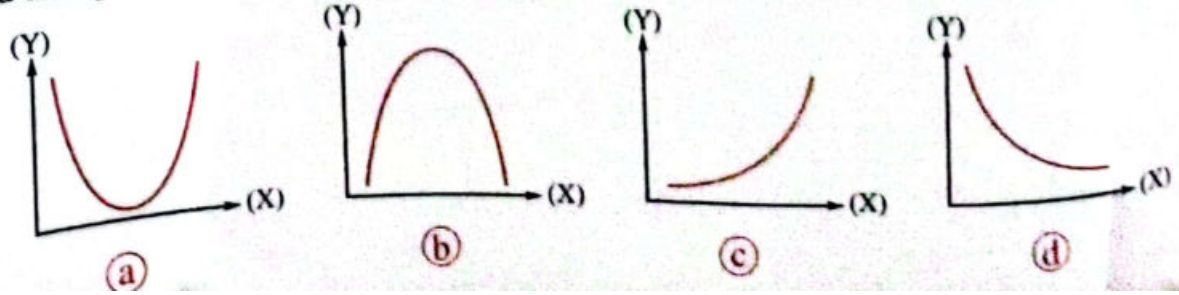
(a) The channels of sodium are opened.

(b) The channels of potassium are opened.

(c) The channels of sodium are opened and the channels of potassium are closed.

(d) The channels of potassium are opened and the channels of sodium are closed.

12 Which of the following graphs represents the relation between the diameter of nerve fiber (X) and the speed of nerve impulse propagation (Y) ?



**13** From the recorded information in the opposite table that is about the axons of three nerve cells, which choice in the following table represents the probable speed for passing the nerve impulse in each of them ?

| Nerve cell | Myelin presence | Axon diameter (µm) |
|---|---|---|
| A | Coated by myelin | 12 to 20 |
| B | Coated by myelin | Less than 3 |
| C | Uncoated by myelin | 0.4 to 1.2 |

| | A | B | C |
|---|---|---|---|
| (a) | 0.5 – 2 m/s | 3 – 15 m/s | 70 – 120 m/s |
| (b) | 3 – 15 m/s | 70 – 120 m/s | 0.5 – 2 m/s |
| (c) | 70 – 120 m/s | 3 – 15 m/s | 0.5 – 2 m/s |
| (d) | 70 – 120 m/s | 0.5 – 2 m/s | 3 – 15 m/s |

**14** In a scientific experiment for studying the properties of nerve impulse transmission in different nerve fibers, it was observed that the transmission speed increases in nerve fiber (X) more than nerve fiber (Y). What is the difference between those nerve fibers ?

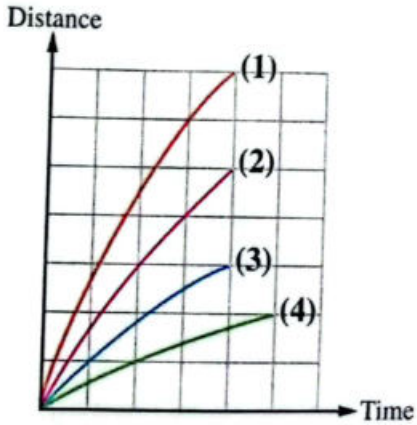
(a) The diameter of fiber (Y) is greater than that of fiber (X).

(b) Fiber (X) is myelinated, but fiber (Y) is non-myelinated.

(c) Fiber (X) is longer than fiber (Y).

(d) Fiber (Y) is myelinated, but fiber (X) is non-myelinated.

**15** Study the opposite graph which expresses the rate of nerve impulse transmission inside a group of different nerve fibers, then determine : Which curve represents the speed of nerve impulse in the nerve fiber with the least diameter ?



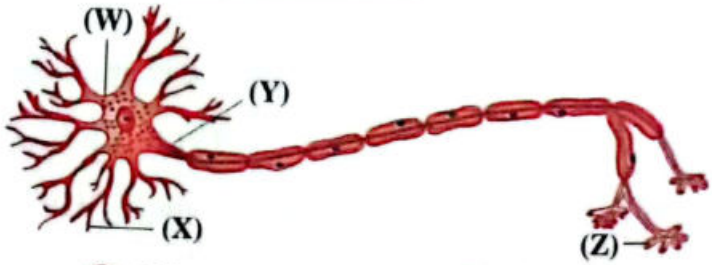

(a) (1).

(b) (2).

(c) (3).

(d) (4).

**16** In the opposite figure, when stimulating this nerve cell at point (Y), through which of the following points the nerve impulse transmits to the neighbouring nerve cell ?



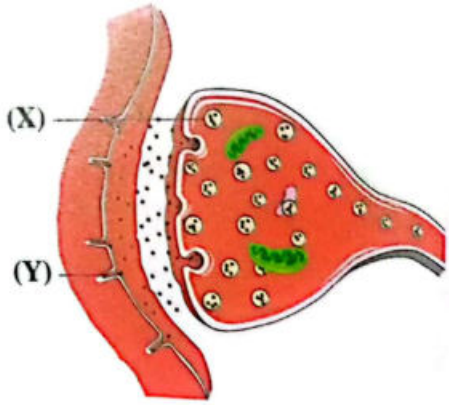

(a) (W).

(b) (X).

(c) (Y).

(d) (Z).

**17** From the opposite figure :




(1) Which of the following statements **doesn't** agree with structure (X) ?

ⓐ It is affected by calcium ions.

ⓑ Its content is affected by cholinesterase enzyme.

ⓒ It contains neurotransmitters.

ⓓ It is found in the cell bodies of neurons.

(2) What does structure (Y) represent ?

ⓐ Sodium-potassium pump. ⓑ Calcium pump.

ⓒ Schwann cell. ⓓ A channel for passing sodium and calcium ions.

---

**18** Which of the following **doesn't** agree with the functions of nerve cells in human ?

ⓐ The transmission of the nerve impulses.

ⓑ The transmission of the nerve impulse from the sense organs to the central nervous system.

ⓒ The transmission of the nerve impulse from the central nervous system to the effector (responding) organs.

ⓓ The transmission of the neurotransmitters from presynaptic membrane to the sensory receptors.

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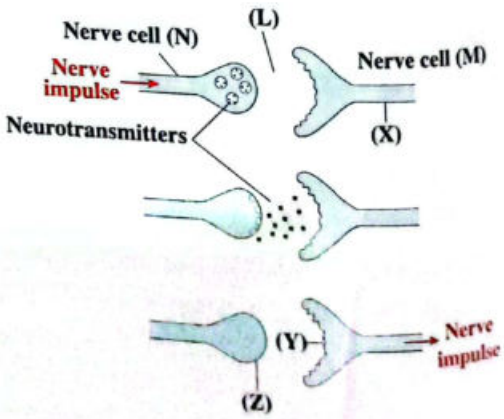
**19** The opposite figure represents the transmission of nerve impulse through the synapse between two neurons :




(1) What is the structure where the calcium pumps are present ?

ⓐ (X). ⓑ (Y).

ⓒ (Z). ⓓ (L).

(2) What is the structure where the receptors of the neurotransmitters exist ?

ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (L).

(3) What is(are) the structure(s) that extend(s) from the body of the nerve cell ?

ⓐ (X). ⓑ (Y). ⓒ (Y) & (Z). ⓓ (X) & (Y).

(4) What is the structure where the cholinesterase enzyme is present ?

ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (L).

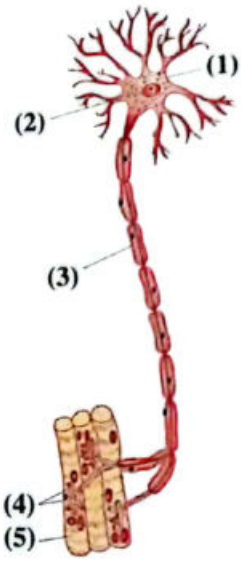
**20** What happens when binding the acetylcholine compounds with their specific receptors on the membranes of dendrites ?

(a) The inflow of ($Na^+$) to the postsynaptic membrane.
(b) The inflow of ($Na^+$) to the presynaptic membrane.
(c) The inflow of ($K^+$) to the postsynaptic membrane.
(d) The inflow of ($K^+$) to the presynaptic membrane.

**21** Which of the following is caused by acetylcholine ?

(a) The formation of electrical potential difference of the nerve cell at rest state.
(b) The transmission of nerve impulse through the synaptic regions.
(c) The increase of the nerve cell polarization.
(d) Increasing the permeability of the postsynaptic membrane to both ($Na^+$) and ($K^+$) to outside the cell.

**22** From the opposite figure :




**(1)** What is the type of the cell that is illustrated in the figure ?

(a) A sensory neuron.
(b) A connector neuron.
(c) A motor neuron.
(d) A glial cell.

**(2)** Which of the following flow(s) from structure no.(4) to structure no.(5) during the transmission of nerve impulse ?

(a) Calcium ions.
(b) Potassium ions.
(c) Cholinesterase enzyme.
(d) Acetylcholine.

**(3)** What is the structure that contributes in increasing the nerve impulse speed ?

(a) (1). (b) (2). (c) (3). (d) (4).

**(4)** Where is the acetylcholine compound stored ?

(a) (1). (b) (2). (c) (4). (d) (5).

**23** The people who suffer from a deficiency in parathormone hormone have low level of calcium ions in blood. What is the effect of that on the nerve impulse transmission in the synapse between the neuron and muscle fiber ?

(a) Breaking down of acetylcholine in the vesicles.
(b) Decreasing in the amount of acetylcholine in the vesicles.
(c) Delaying the release of acetylcholine.
(d) Changing the shape of acetylcholine receptors.

**24** Which of the following represents the efferent neuron in the synapse between a neuron and a muscle fiber ?

(a) Motor. (b) Sensory. (c) Connector. (d) Mixed

**25** In which of the following the postsynaptic membrane differs from the presynaptic membrane ?

(a) The presence of calcium pumps.

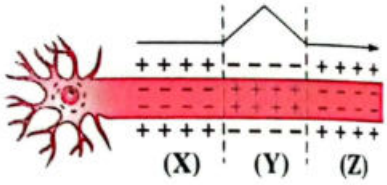
(b) The presence of neurotransmitters vesicles.

(c) The presence of sodium channels.

(d) The absence of potassium channels.

---

**26** The opposite figure shows the transmission of the nerve impulse, study the following statements, then answer :




**(1)** The electrical change occurs in part (X), due to the inflow of ($Na^+$) by diffusion.

**(2)** The maximum potential difference in part (Y) is + 40 mV.

**(3)** Part (Z) is in a polarization state and the ions concentration on the two sides of membrane is equal.

Which of the previous statements is **incorrect** ?

(a) (1) and (2).

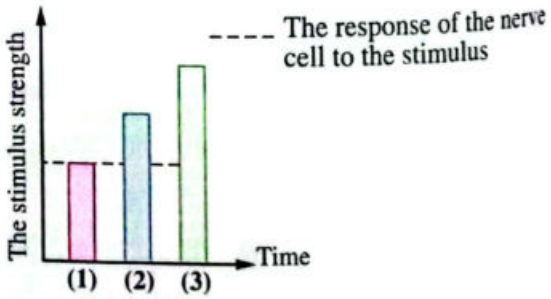
(b) (1) and (3).

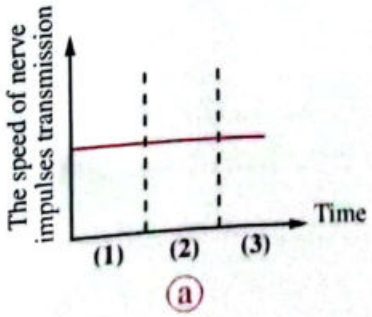
(c) (2) and (3).

(d) (1), (2) and (3).

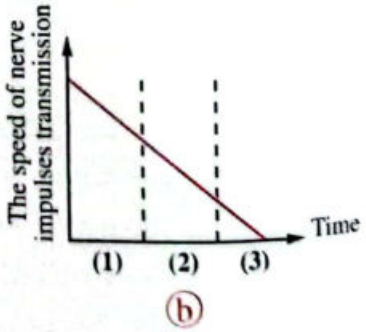
---

**27** The opposite graph shows the change in the strength of three stimuli that affect a nerve cell. Which of the following graphs represents the change in the speed of the nerve impulses transmission ?

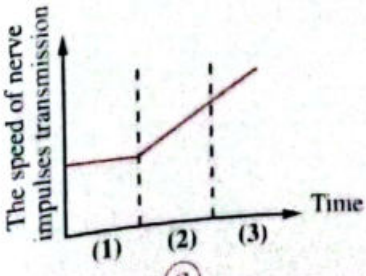


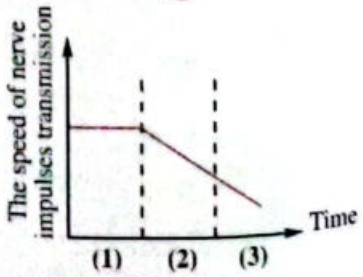

(a)




(b)

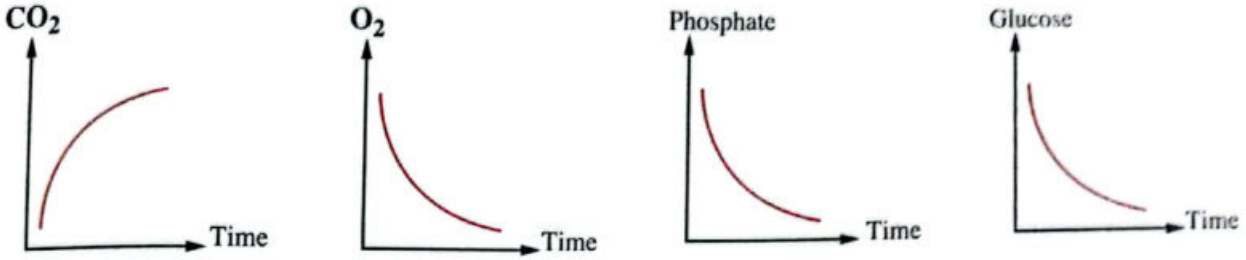



(c)




(d)

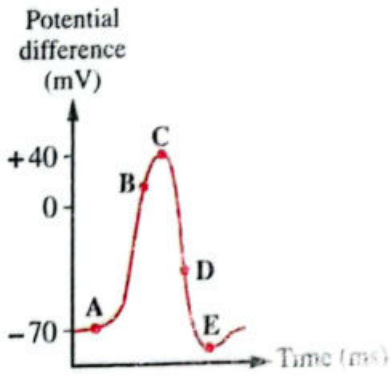
28 Which of the following graphs is **incorrect** about the results of the nerve impulse transmission through the nerve cell ?




(a) (b) (c) (d)

---

29 The opposite graph shows the stages through which the neuron passes during stimulation :




(1) ✱ At which point the sodium ions concentration reaches the maximum value on the inner side of nerve cell membrane ?

(a) A (b) B
(c) C (d) D

(2) At which point the potassium ions concentration reaches the maximum value on the outer surface of nerve cell membrane ?

(a) A (b) B (c) D (d) E

---

30 ✱ Which of the following is related to the resting potential ?

(a) Action potential.
(b) The outflow of potassium ions from the cell.
(c) The equal distribution of ions.
(d) The isolation by Schwann cells.

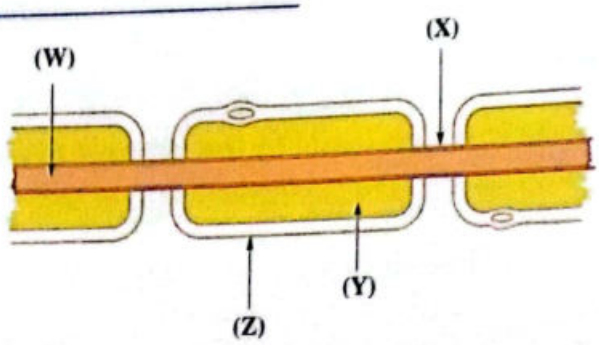
---

31 ✱ Which of the following states takes place when the potential difference reaches (− 80 mV) on the two sides of the nerve fiber membrane ?

(a) Depolarization. (b) Increasing polarization.
(c) Action potential. (d) Resting potential.

---

32 ✱ From the opposite figure, at which point do the polarization and depolarization happen ?




(a) (W). (b) (Y).
(c) (X). (d) (Z).

Understand Apply Analyze

33 * Which of the following is needed by the nerve fiber membrane during the refractory period to restore its physiological properties ?

(a) Calcium ions. (b) Acetylcholine. (c) Cholinesterase. (d) ATP

34 * Which of the following the speed of the nerve impulse transmission **doesn't** depend on it ?

(a) The presence of myelin sheaths. (b) The diameter of nerve fiber.

(c) The presence of acetylcholine. (d) The increase in the stimulus strength.

35 * Supposing the connection of the terminal arborizations of a neuron axon with the dendrites of five neighbouring neurons. Which of the following will occur to the nerve impulse that passes through this axon ?

(a) It will transfer to the five neurons with the same strength and response.

(b) It will be distributed on the five neurons, resulting in a weak response.

(c) It will transfer through one of the five neurons with the same strength.

(d) It will not transfer to any one of these neurons.

36 * What is the result of the absence of cholinesterase enzyme from the synapse region ?

(a) The occurrence of polarization. (b) The continuity of depolarization state.

(c) The opening of sodium channels. (d) The occurrence of refractory period.

## Second Miscellaneous Questions

1 **Explain :** the structure of plasma membrane of nerve cell contributes in the generation of nerve impulse.

2 **Explain :** the propagation of nerve impulse occurs in the form of successive waves of depolarization, repolarization then depolarization again.

3 **What happens in case of :** stimulating a nerve cell by another neighbouring nerve cell ?

4 **What happens in case of :** the arrival of a strong stimulus to a nerve cell, after stimulating the nerve in time less than 0.001 of second ?

5 **"When the nerve fiber is subjected to a certain stimulus, a group of changes occurs to it which leads to the occurrence of depolarization state to the nerve fiber":**

**(a) Explain how** the depolarization of nerve fiber occurs.

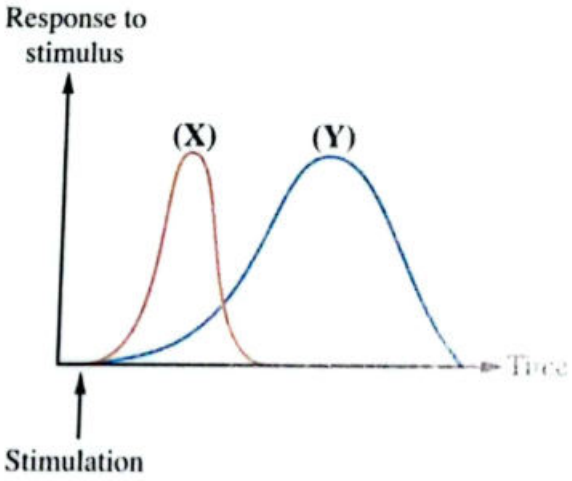
**(b) How** does the nerve cell or nerve fiber return to its original state at rest (polarization) ?

6 **Compare between :** calcium pump and sodium-potassium pump in the nervous tissue, **"according to :** the function – the effect of its action".

7 **Explain how :** the electrical potential difference of the nerve cell is formed at the rest state.

8 **What happens in case of :** vanishing the stimulus that affects the nerve cell ?

9 **In the opposite graph, if you know that the nerve fibers of type (A) are myelinated, while the nerve fibers of type (B) are non-myelinated :**



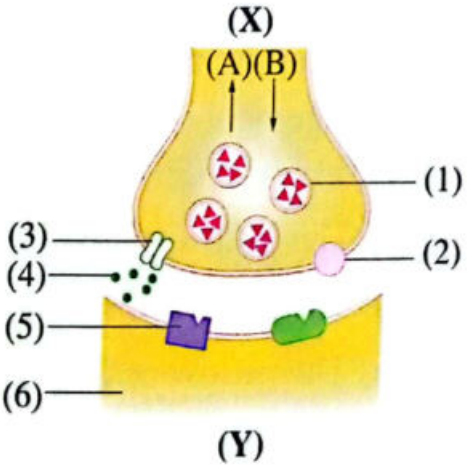

(a) **Which** curve (X) or (Y) describes the transmission of nerve impulse in (A) and (B) ? **Explain your answer.**

(b) **Which** nerve fiber do you expect that its radius is larger ? **Explain your answer.**

10 **What happens in case of :** the absence of synaptic vesicles from the buttons (synaptic knobs) ?

11 **Explain :** the ability of nerve impulse to transmit across the synaptic cleft.

12 **The following figure represents the transmission of nerve impulse through the synapse :**




(a) **Mention the number and name of the structure that :**

1. Receives the acetylcholine.
2. Contains the neurotransmitters.

(b) **Which** arrow (A) or (B) represents the direction of the nerve impulse ?

(c) **What** is the importance of structure no. (4) in transmitting the nerve impulse ?

(d) **What** is the difference between (X) and (Y) ?

(e) **What** is the relation between structure no. (3) and the nerve impulse ?

(f) "The previous structure works as a valve". **How far is this statement correct ? With explanation.**

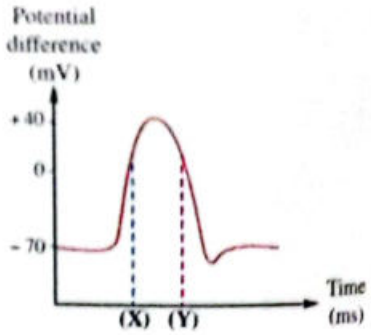
## Choose the correct answer :

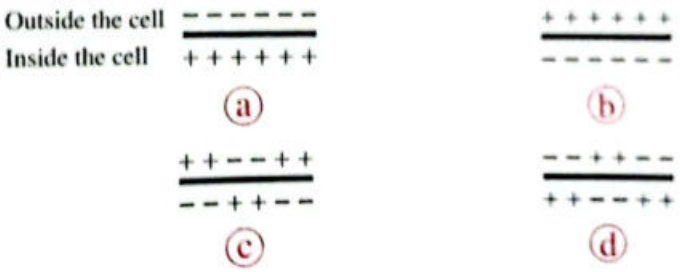
**1** By analyzing the values that recorded in the opposite table that represent the concentrations of three different elements, what would ions (X), (Y) and (Z) represent respectively (at the rest state) ?

| | Inside the nerve cell membrane | Outside the nerve cell membrane |
|---|---|---|
| X | 15 mM | 145 mM |
| Y | 10 mM | 110 mM |
| Z | 150 mM | 5 mM |

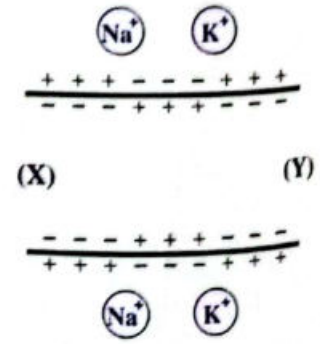
(a) Sodium / Potassium / Chloride.
(b) Potassium / Sodium / Chloride.
(c) Potassium / Chloride / Sodium.
(d) Sodium / Chloride / Potassium.

**2** From the opposite graph, which of the following figures expresses the period of time between the two points (X) and (Y) ?



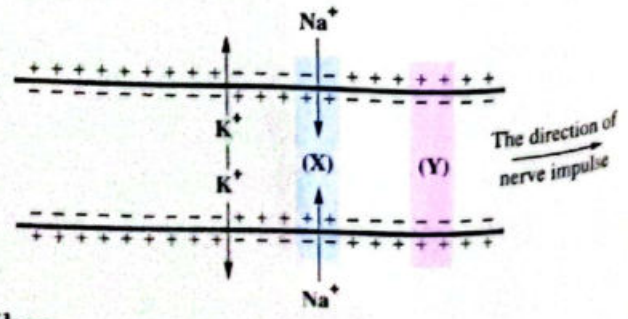




**3** The opposite figure illustrates a part of nerve fiber during stimulation, which of the following represents the correct arrangement of ions movement and the direction of nerve impulse respectively ?




(a) The inflow of ($Na^+$) and outflow of ($K^+$) / From (X) to (Y).
(b) The inflow of ($Na^+$) and outflow of ($K^+$) / From (Y) to (X).
(c) The inflow of ($Na^+$) and ($K^+$) / From (X) to (Y).
(d) The inflow of ($Na^+$) and ($K^+$) / From (Y) to (X).

**4** From the opposite figure, which of the following occurs to region (Y), when the change that happened at region (X) reaches it ?




(a) Depolarization takes place.
(b) The potential difference becomes about –70 mV.
(c) The membrane returns to the rest state.
(d) The potassium ions enter inside the nerve fiber.

**5** By which of the following is the membrane of the nerve fiber characterized in the stage that its outside is positive and its inside is negative and no new nerve impulse could be transmitted through it ?

(a) It is positive from outside, due to the accumulation of ($K^+$) outside.
(b) It is negative from inside, due to the accumulation of ($Na^+$) outside.
(c) It is positive from outside, due to the accumulation of ($Na^+$) outside.
(d) It is negative from inside, due to the accumulation of ($K^+$) inside.

**6** On comparing the required amount of energy for passing the nerve impulse in two neurons axons, one of them is coated with myelin substance and the other one is uncoated, what do you expect the required amount of energy to be in order to pass the nerve impulse in the non-myelinated axons ?

(a) Less than the energy required for passing it in the coated axons.
(b) Higher than the energy required for passing it in the coated axons.
(c) Equal to the energy required for passing it in the coated axons.
(d) Not related to the energy required for passing it in the coated axons.

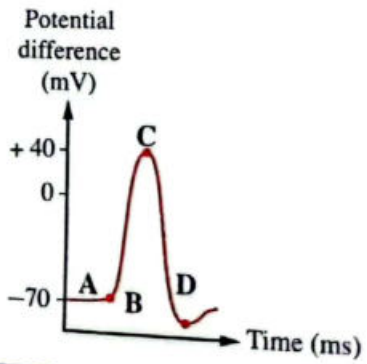
**7** In an experiment, a muscle fiber has been stimulated by nerve stimuli with different strength, and the results illustrated as in the two opposite graphs, what could you conclude from that ?



(a) The more increase in the stimulus strength, the more increase in the contraction strength.
(b) As long as the stimulus is present, the contraction has to be happened.
(c) The contraction starts after reaching the stimulus strength to a certain value.
(d) For reaching the highest contraction strength, the stimulation must be with a maximum stimulus strength.

## Answer the following questions :

**8** **The opposite graph illustrates a nerve fiber which was exposed to a stimulus :**




(a) **What** does the state of nerve fiber represent at (A) and (C) ?
(b) **Compare between** period (BC) and period (CD).
(c) **Compare between** the permeability of nerve fiber membrane at the two states which are represented by (A) and (C).

**9** Some predators inject their preys by a poisonous substance, causing the paralysis of the prey and facilitating its hunting. **In the light of your study, explain the reason for the inability of the prey to move.**

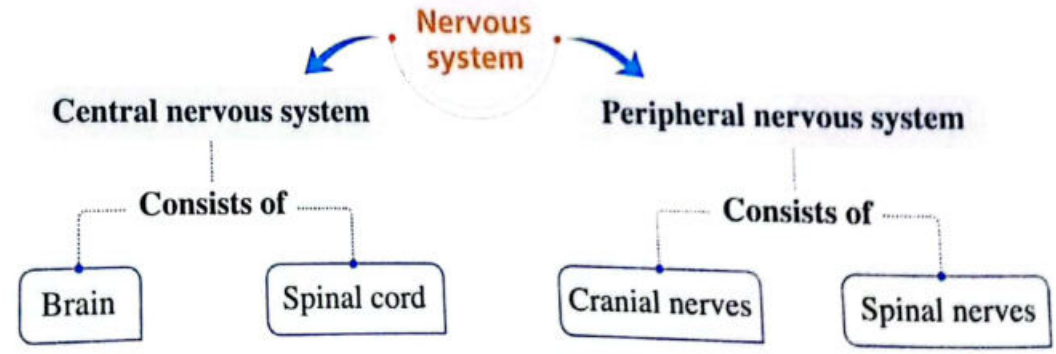
**Why** do you think, this girl can recognize the food type without seeing it ?

Chapter 5

Lesson Four

# Central Nervous System

## Structure of the nervous system



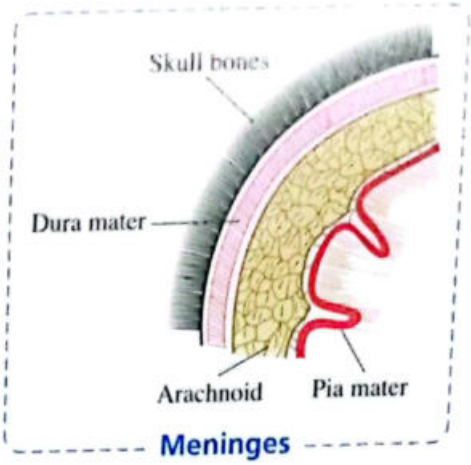

## First Central nervous system

### 1 Brain

- **It forms the largest part of central nervous system, where its weight reaches about :**
  - 350 grams at birth.
  - 1400 grams in the adult man.
- It occupies (exists inside) a strong bony space called the brain case or the skull (cranium).
- It is surrounded by three membranes called "meninges" which are responsible for the protection and nourishment of the brain cells.

• **These membranes are :**

1. **The dura mater :** it is a membrane which lines the skull bones.
2. **The pia mater :** it is a membrane which adheres to the brain surface.
3. **The arachnoid :** it is a membrane which fills the space between the other two membranes (outer dura and inner pia), and contains a transparent fluid to protect the brain from the mechanical trauma.



Meninges

## Test yourself

Answered

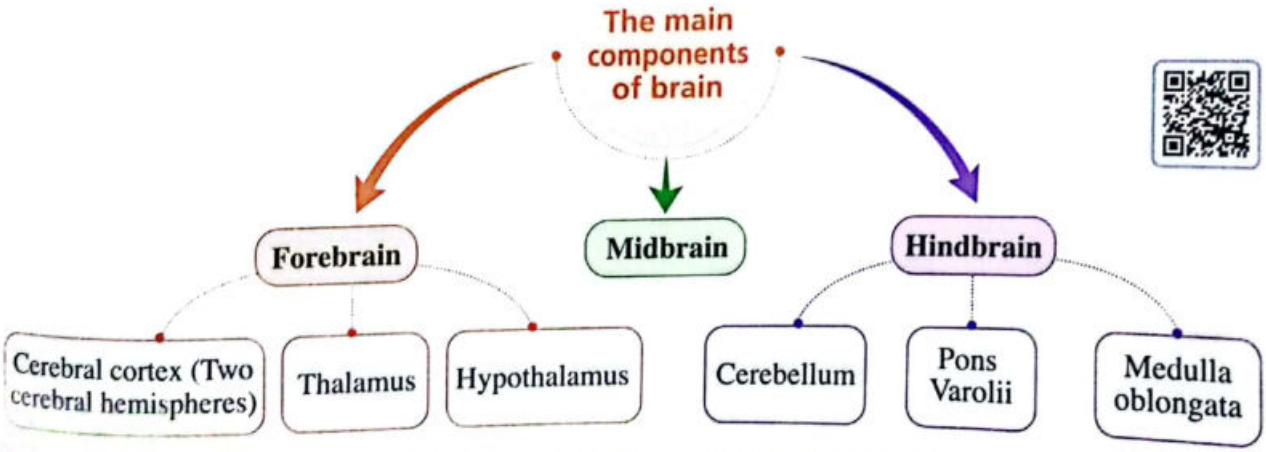
**Choose the correct answer :**

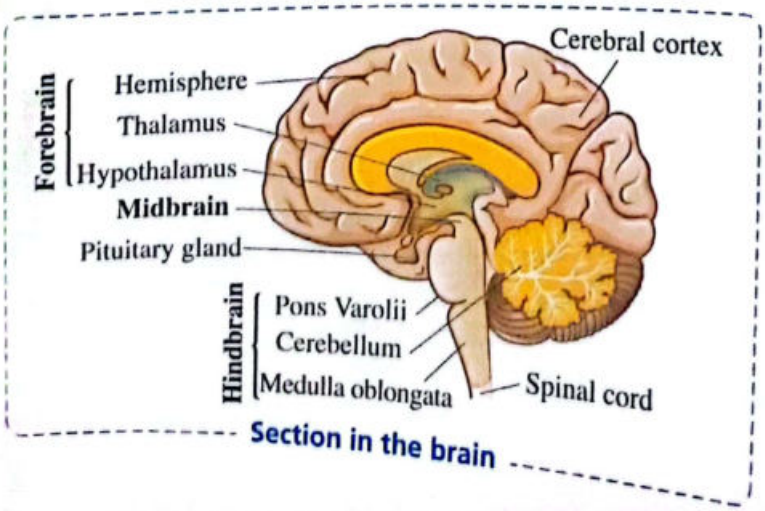
Which of the following represents the ratio between the brain at birth to its weight at puberty ?

ⓐ 1 : 2 ⓑ 1 : 3 ⓒ 1 : 4 ⓓ 1 : 5

• There are 12 pairs of cranial nerves that are connected to the brain (in human).

**The following diagram shows the main components of brain :**



Section in the brain

• We will study briefly the structure and function of each part of the brain, as follows :

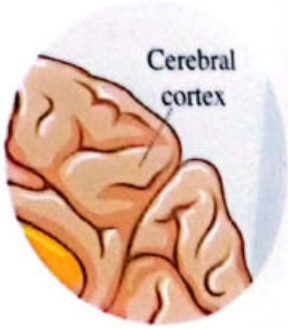
## A Forebrain

• **It represents the largest part of the brain, and it consists of :**

### 1 Cerebral cortex (Two cerebral hemispheres) :

• Two big lobes, where each lobe of them is called "cerebral hemisphere" and they are separated by a big fissure, but connected together by a big bundle of nerve fibers.

• The cerebral cortex is characterized by the presence of depressions of different depths called "fissures and grooves", and between them there are folds.




• Each cerebral hemisphere is divided into five lobes, **which are :**
- Frontal lobe.
- Parietal lobe.
- Occipital lobe.
- Temporal lobe.
- The 5th lobe which is not seen from the external shape, because it is covered by the frontal and parietal lobes.

**Note**

The 5th lobe can be seen in the transverse section of the cerebral cortex.

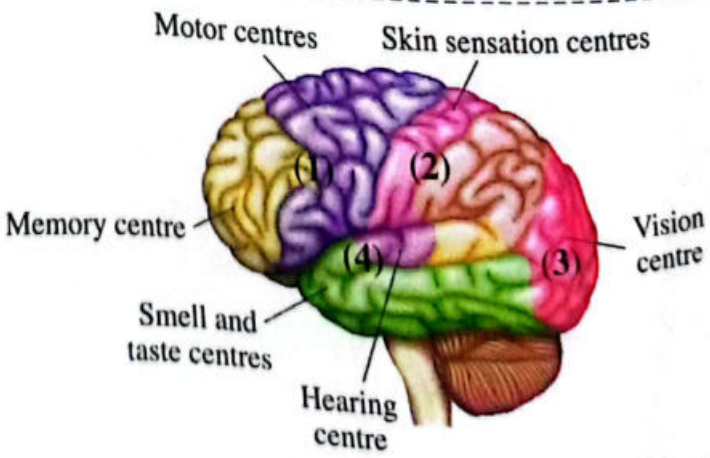
• **Functions of cerebral cortex :**

**(1) Frontal lobe :** contains centres of voluntary movements (motor centres) and some centres of speech and memory.

**(2) Parietal lobe :** controls many sensory functions, such as sensation of heat, cold, pressure and touch (somatic sensations of skin).

**(3) Occipital lobe :** contains sensitive centres that control the sight sense.

**(4) Temporal lobe :** contains centres of smell, taste and hearing senses.




Brain centres

**2 Thalamus :**

- **Function :**

It is an important centre for the coordination of sensory nerve impulses that reach the cerebral cortex (except the smell).


**3 Hypothalamus :**

- **Function :**

It contains many centres that control the reflex actions, such as centres of :

- Hunger.
- Satiety.
- Thirst.
- Sleep.
- Body temperature regulation.

## 2 Test yourself

Answered

**Choose the correct answer :**

Which of the following brain lobes **doesn't** have a role in controlling any of the five body senses ?

(a) Parietal lobe. (b) Occipital lobe. (c) Temporal lobe. (d) Frontal lobe.

## B Midbrain


- It is considered the smallest part of the brain.
- It represents a link between the forebrain and hindbrain.
- **Functions :**
  - It contains nervous centres that keep the body balance (equilibrium).
  - It contains centres that are connected with hearing and vision.
  - It regulates many reflexes, such as those that related to hearing.

## 3 Test yourself

Answered

**Determine a similarity between :** the forebrain and midbrain, **"according to : the function"**.

.....

.....

## C Hindbrain

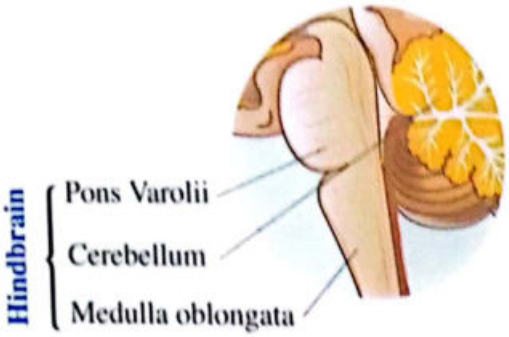
- **It consists of :**

- It exists in the posterior region and consists of three lobes.

**1 Cerebellum :**

- **Function :**

It keeps the body balance (equilibrium) with the help of the inner ear and body muscles.




**2 Pons Varolii :**

- **Functions :**

- Each of Pons Varolii and medulla oblongata works on the transmission of nerve impulses from the spinal cord to the different parts of brain.

**3 Medulla oblongata :**

- Medulla oblongata contains some vital centres in the body, **the most important ones are :**
  - Respiratory centres.
  - Blood vessels movement regulatory centres.
  - Swallowing, vomiting, sneezing and cough centres.

## 4 Test yourself

Answered

"The individual's life depends on the action of hindbrain". **How far is this statement correct ? With explanation.**

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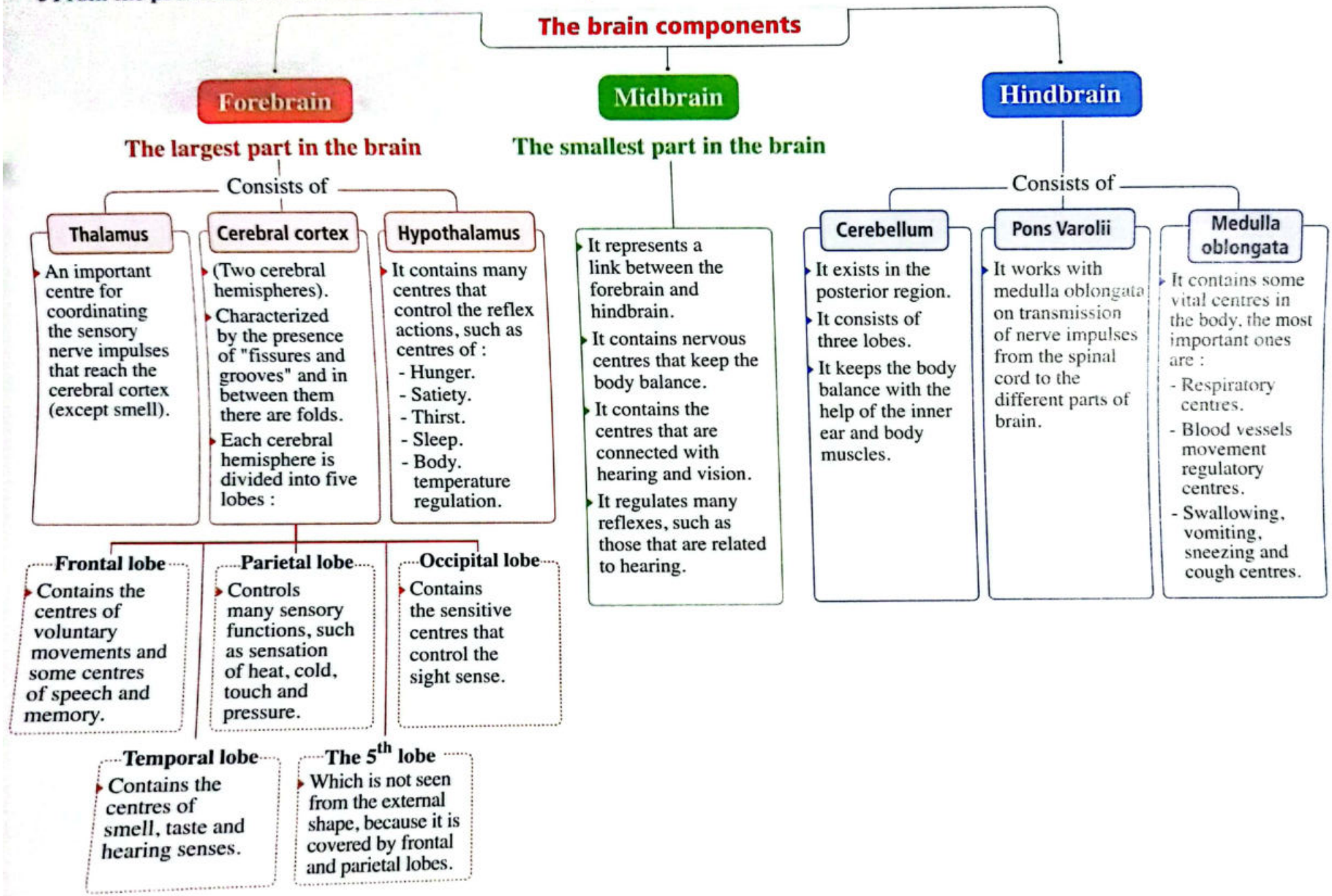
• *From the previous, we can summarize the brain components in the following diagram :*



## 2 Spinal cord

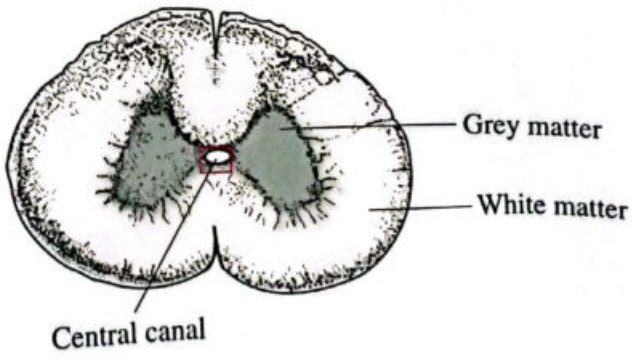
- It exists inside a canal that is present inside the vertebral column (vertebrae) and called the "neural canal" or "spinal canal".
- It starts from the medulla oblongata of brain and extends along the vertebral column.
- Its length reaches about 45 cm long in the adult man.
- It is hollow from inside, because it contains a small canal called "central canal".
- There are two fissures (dorsal and ventral) that extend along the midline and divide the spinal cord incompletely into two halves.
- It is covered by three membranes (meninges), which are from outside to inside, **as follows :**
  - Dura mater. - Arachnoid. - Pia mater.
- **Structure of the spinal cord : its tissue consists of two layers :**

### 1 Inner layer

- It is the **grey matter** which looks like (H) letter (**i.e.** it is H-shaped).
- It is formed of nerve cells' bodies, dendrites and neuroglia (glial cells).
- **Its function :** it is considered the main centre of reflex actions, where the spinal cord contains thousands of reflex arcs.
- It has two dorsal and two ventral horns.

### 2 Outer layer

- It is the **white matter**.
- It is formed of nerve fibers.
- **Its function :** it acts as a transmitter for the nerve impulses from all the different body parts to the main centres in brain and vice versa.




Section in the spinal cord

### Key Point

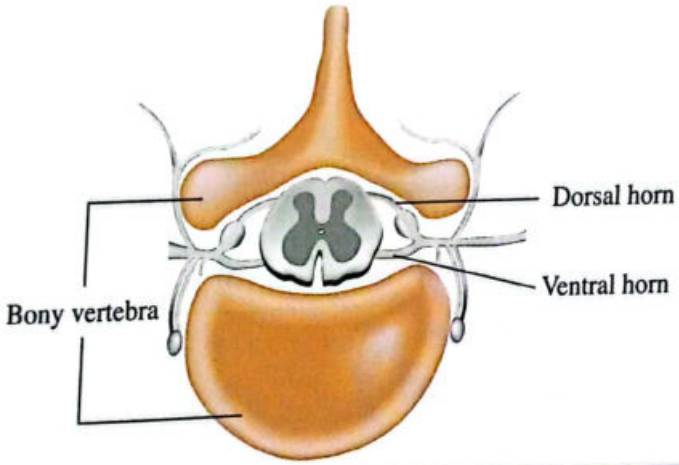
The nervous system region that mostly contains fatty substances is the white matter, because it is formed of nerve fibers which contain the myelin substance that is considered a fatty substance.

**Remember that**

When examining a section in the cerebral cortex, we find that the inner layer is the white matter and the outer layer is the grey matter.

**For illustration only**

- **Section illustrates the spinal cord inside the neural canal of a bony vertebra :**




## Test yourself

Answered

Give reason for : the inner layer of the spinal cord is called the grey matter.

.....

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Chapter 5

Questions on Lesson Four

# Central Nervous System

Use the App GPS

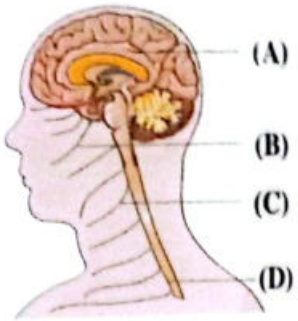
The questions signed by * are answered in detail.

Understand Apply Analyze

Interactive test

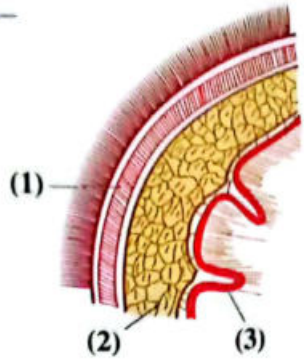
## First Multiple Choice Questions

1 In the opposite figure, what are the parts that represent the central nervous system ?



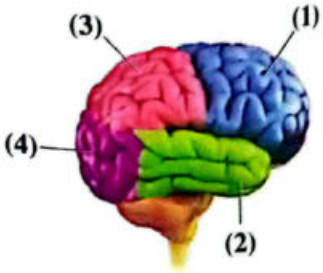

(a) (A) and (C).
(b) (B) and (C).
(c) (A) and (D).
(d) (C) and (D).

2 What is the arrangement of the structures from no.(1) : (3) in the spinal cord from inside to outside ?




(a) (1) / (2) / (3).
(b) (3) / (2) / (1).
(c) (1) / (3) / (2).
(d) (2) / (1) / (3).

3 In the opposite figure, what do lobes no.(1), (2), (3) and (4) represent respectively ?




(a) Frontal lobe / Parietal lobe / Occipital lobe / Temporal lobe.
(b) Parietal lobe / Frontal lobe / Temporal lobe / Occipital lobe.
(c) Frontal lobe / Temporal lobe / Parietal lobe / Occipital lobe.
(d) Temporal lobe / Frontal lobe / Occipital lobe / Parietal lobe.

4 Which of the following lobes is found in front of the parietal lobe ?

(a) The occipital lobe.
(b) The temporal lobe.
(c) The frontal lobe.
(d) The 5th lobe.

5 Which of the following **isn't** from the cerebral cortex functions ?

(a) Learning a new language.
(b) The sensation of temperature.
(c) Maintaining the body balance.
(d) The movement of thumb.

6 Where are the voluntary motor centres present ?

ⓐ Beneath the occipital lobe.

ⓑ Above the temporal lobe.

ⓒ Behind the parietal lobe.

ⓓ Between the parietal lobe and occipital lobe.

7 A person was injured in an accident with amnesia, which of the following brain lobes may be affected ?

ⓐ Occipital lobe. ⓑ Temporal lobe. ⓒ Frontal lobe. ⓓ Parietal lobe.

8 Which of the following is connected with the pituitary gland ?

ⓐ Hypothalamus. ⓑ Thalamus. ⓒ Midbrain. ⓓ Pons Varolii.

9 From the opposite figure, what are the two different nervous centres that are found in the same lobe of brain ?

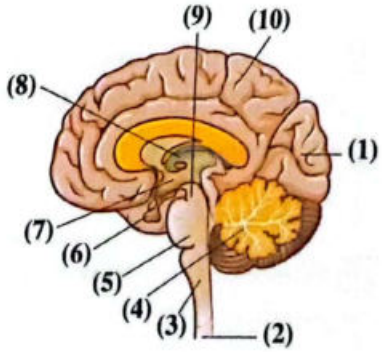

ⓐ (1) and (5).

ⓑ (2) and (3).

ⓒ (3) and (4).

ⓓ (4) and (5).

10 From the following figure :




(1) What is the structure whose action is affected severely on drinking alcohols ?

ⓐ (1). ⓑ (2).

ⓒ (4). ⓓ (6).

(2) What is the structure whose injury leads to losing the sight sense ?

ⓐ (1). ⓑ (3).

ⓒ (5). ⓓ (7).

(3) What is the structure through which the coordination of reflex actions of hearing occurs ?

ⓐ (3). ⓑ (5). ⓒ (7). ⓓ (9).

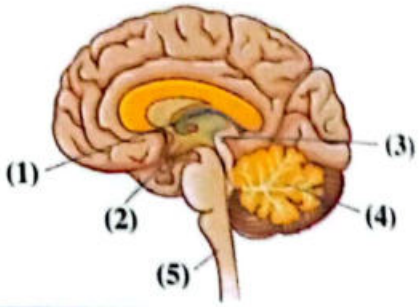
(4) What is the structure that represents the centre of sleep and regulation of the body temperature ?

ⓐ (3). ⓑ (5). ⓒ (7). ⓓ (8).

(5) What is the structure that is responsible for receiving the sensory stimuli from all the body limbs ?

ⓐ (4). ⓑ (6). ⓒ (8). ⓓ (10).

**11** Which of the following **don't** represent correctly the numerated part and its function ?




ⓐ (2) / Regulating the body temperature.
ⓑ (3) / Muscles movement.
ⓒ (4) / Maintaining the body balance.
ⓓ (5) / Regulating the reflex action.

**12** Which of the following causes the recognition of the coming nerve impulses from the sense organs as a vision, hearing, smell, pain, stress or odour ?

ⓐ The speed of nerve impulses transmission.
ⓑ The different nerve centres that recieve nerve impulses.
ⓒ The arrival timing of nerve impulses.
ⓓ The number of nerve cells that transmit the nerve impulse.

**13** Which of the following signals reaches directly the cerebral cortex without passing through thalamus ?

ⓐ The apple fruit colour.
ⓑ The sweet taste.
ⓒ The coldness of an ice cube.
ⓓ The perfume odour.

**14** Which of the following brain parts is its action related to the vision ability ?

ⓐ Cerebellum.
ⓑ Temporal lobe.
ⓒ Hypothalamus.
ⓓ Midbrain.

**15** Which of the following brain parts is responsible for coordinating the afferent auditory nerve impulses to the cerebral cortex ?

ⓐ Temporal lobe.
ⓑ Thalamus.
ⓒ Cerebellum.
ⓓ Midbrain.

**16** Which of the following nervous system's parts translates the light stimulus into nerve impulses ?

ⓐ Cerebellum.
ⓑ Two cerebral hemispheres.
ⓒ Spinal cord.
ⓓ Hypothalamus.

**17** What is the brain part that sends signals causing a high desire of eating when the stomach is empty ?

ⓐ Thalamus.
ⓑ Midbrain.
ⓒ Cerebral cortex.
ⓓ Hypothalamus.

**18** What is the part which **isn't** affected when a person is subjected to high sound waves during a scientific lecture ?

ⓐ Cerebral cortex.
ⓑ Cerebellum.
ⓒ Thalamus.
ⓓ Midbrain.

19 Which of the following parts of the brain acts as a bridge between the spinal cord and the different parts of brain ?

ⓐ Midbrain. ⓑ Cerebellum. ⓒ Hypothalamus. ⓓ Pons Varolii.

---

20 Where is Pons Varolii located ?

ⓐ Behind the cerebellum and beneath the medulla oblongata.

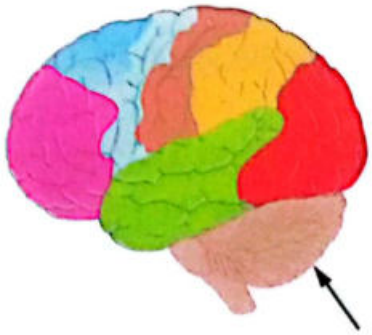
ⓑ In front of the cerebellum and above the medulla oblongata.

ⓒ Beneath the midbrain and in front of the pituitary gland.

ⓓ Above the midbrain and behind the pituitary gland.

---

21 What happens when a damage occurs in the part that is referred to in the opposite figure ?



ⓐ A change in the body temperature.

ⓑ A rapid breathing.

ⓒ A disturbance in the body balance.

ⓓ Amnesia.

---

22 Where are the centres of the higher functions in the brain present ?

ⓐ Medulla oblongata. ⓑ Spinal cord.

ⓒ Cerebellum. ⓓ Two hemispheres.

---

23 Which of the following **isn't** considered a similarity between the brain and spinal cord ?

ⓐ Each of them is protected by bony tissues.

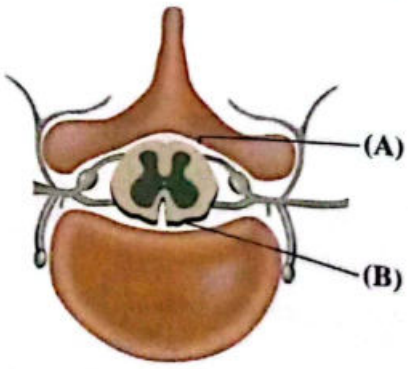
ⓑ Each of them is surrounded by the same meninges.

ⓒ Each of them contains dorsal and ventral horns.

ⓓ Each of them is divided into two regions.

---

24 The opposite figure shows the spinal cord inside the neural canal of a bony vertebra :




(1) Which of the following membranes lines structure (A) from inside ?

ⓐ Pia mater. ⓑ Arachnoid.

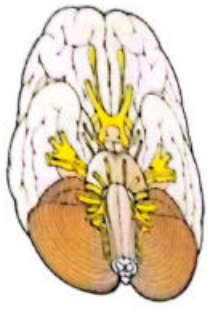
ⓒ Dura mater. ⓓ Myelin sheath.

(2) Which of the following membranes surrounds structure (B) ?

ⓐ Pia mater. ⓑ Arachnoid.

ⓒ Dura mater. ⓓ Myelin sheath.

25 ✱ The opposite figure illustrates the lower surface of the brain, which of the following lobes are hidden in this figure ?



(a) Frontal, 5th and occipital lobes.
(b) 5th, frontal and parietal lobes.
(c) Occipital, parietal and 5th lobes.
(d) 5th, parietal and temporal lobes.

26 ✱ When an accident is occurred to a person, he lost the sensation in his right leg, but he was able to move it, which of the following lobes would you expect to be damaged ?

(a) Occipital lobe. (b) Temporal lobe. (c) Parietal lobe. (d) Frontal lobe.

27 ✱ Through which of the following can the 5th lobe of the cerebral cortex be seen ?

(a) The lower surface of brain.
(b) The upper surface of brain.
(c) The transverse section of the cerebral cortex.
(d) The lateral view of the cerebral cortex.

28 ✱ Which of the following cooperate together to make the body adapt with the change in the surrounding temperature ?

(a) Parietal lobe and hypothalamus.
(b) Occipital lobe and hypothalamus.
(c) Parietal lobe and thalamus.
(d) Temporal lobe and hypothalamus.

29 ✱ What happens when the medulla oblongata is injured by a severe damage ?

(a) Losing the sense of sight.
(b) General paralysis occurs.
(c) Losing the ability to speak.
(d) Death occurs.

30 ✱ When an accident is occurred to a person, causing a paralysis in his right hand, but he doesn't lose his sensation in this hand, which of the following lobes do you expect to be damaged ?

(a) Occipital lobe. (b) Temporal lobe. (c) Parietal lobe. (d) Frontal lobe.

## Second Miscellaneous Questions

1 **Explain :** the protection of brain depends on different types of tissues.

2 **What is the difference between :** the frontal lobe and occipital lobe of the brain ?

3 **What happens in case of :** anesthetization of the hypothalamus region of brain ?

**4** **Compare between :** forebrain and hindbrain, "**according to :** structure – function".

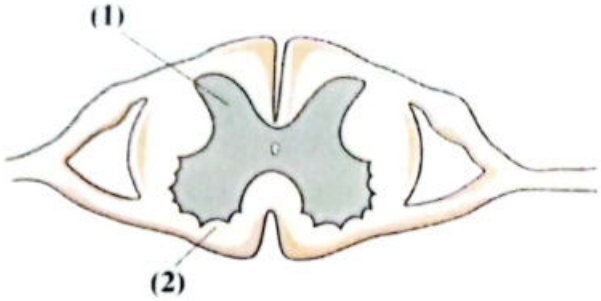
**5** **Mention the part that is responsible for regulating the following functions :**

**(1)** Talking.
(2) Planning for a project.
**(3)** Feeling pain.
(4) Recognizing odours.
**(5)** Recognizing music.
(6) Respiration mechanism.
**(7)** Blood flow inside arteries.

**6** **Compare between :** the spinal cord and medulla oblongata, "**according to :** site – function".

**7** **From the opposite figure :**

**What is the difference between** structure no. (1) and structure no. (2) ?




**8** **Give reason for :** the centre of the reflex actions is the spinal cord not the upper centres of the two cerebral hemispheres.

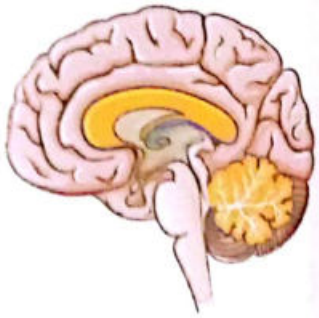
Chapter 5

## Questions that measure high levels of thinking

Answered in detail

Choose the correct answer :

1 In the opposite figure, which of the following statements is the most accurate ?



(a) The 5th lobe can't be seen, due to its covering with the frontal and parietal lobes.
(b) The temporal lobe is completely hidden.
(c) The skin sensory centres are easily determined.
(d) All the brain lobes are completely clear.

2 If you know that each cerebral hemisphere contains nervous centres that control the organs of the half opposite to it, which of the following their injury causes a paralysis in the right arm muscles and the lack of sensation in the left hand respectively ?

(a) Right frontal lobe / Left parietal lobe.
(b) Left frontal lobe / Right parietal lobe.
(c) Left parietal lobe / Right frontal lobe.
(d) Right parietal lobe / Left frontal lobe.

3 Which of the following is the most region containing fat substances ?

(a) Grey matter.
(b) White matter.
(c) Synapses.
(d) Ranvier's nodes.

### Answer the following question :

4 **The opposite figure illustrates a section in a nervous system structure :**

**(a) Conclude** from your study, the name of this structure, and **from which** is it formed ?

**(b)** "This structure cooperates with other body organs to perform an important function inside the body". **What** are these organs ? **And what** is the common function among them ?

**Why** do you think the leg moves, when hitting beneath the knee by a medical hammer ?

Chapter 5

Lesson Five

# Peripheral Nervous System

## Second Peripheral nervous system

- It connects the central nervous system with all the body parts.
- It consists of a network of nerves that are distributed all over the different body parts, **and include :**

### 1 Cranial nerves

- **Number :** 12 pairs connected to the brain.
- **Types :** sensory, motor or mixed nerves.

**Mixed nerves**

They are nerves that transmit the nerve impulses from the receptor organs to the brain and transmit the stimulating orders from the brain to the effector organs, **i.e.** they are sensory and motor nerves together.

### 2 Spinal nerves

- **Number :** 31 pairs are connected to the spinal cord and exist in successive pairs on both sides of spinal cord and these pairs are arranged, **as follows :**

| Nerves | Number |
|---|---|
| 1 Cervical | 8 pairs that are connected with the neck. |
| 2 Thoracic | 12 pairs that are connected with the chest (thorax). |
| 3 Lumbar | 5 pairs that are connected with the lumbar vertebrae. |
| 4 Sacral | 5 pairs that are connected with the sacral vertebrae. |
| 5 Coccygeal | 1 pair that is connected with coccyx. |

- **Types :** mixed (sensory and motor nerves together).
- **Spinal nerves roots :** each spinal nerve has **two roots** (dorsal and ventral) :

| P.O.C. | Dorsal root | Ventral root |
|---|---|---|
| **Structure :** | It contains **sensory** nerve fibers. | It contains **motor** nerve fibers. |
| **Function :** | It transmits **messages** (nerve impulses) from the receptor organs to the spinal cord and the brain. | It transmits **messages** or stimulating motor orders (nerve impulses) that come from the brain and spinal cord to the responding (effector) organs, such as muscles and glands. |

## Key Point

**The vertebrae of the vertebral column (33 vertebrae) are arranged from up to down into five regions, which are :**

– Cervical vertebrae (7). – Thoracic vertebrae (12). – Lumbar vertebrae (5).
– Sacral vertebrae (5). – Coccygeal vertebrae (4).

Therefore, the number of nerves pairs is different from the number of vertebrae in cervical and coccygeal regions.

## 1 Test yourself

Answered

**Choose the correct answer :**

Which of the following cells belong to the peripheral nervous system ?

(a) Sensory cells and connector cells.
(b) Connector cells and motor cells.
(c) Sensory cells and motor cells.
(d) Connector cells and neuroglia.

## Reflex arc (Reflex action)

### Reflex arc

It is the nervous activity unit in the human body.

- The majority of the nervous functions can be analyzed into a group of reflex actions that occur at different levels.

The reflex arc includes two nerve cells at least, **which are :**

- Sensory nerve cell ▸ Afferent
- Motor nerve cell ▸ Efferent

## The reflex arc consists of

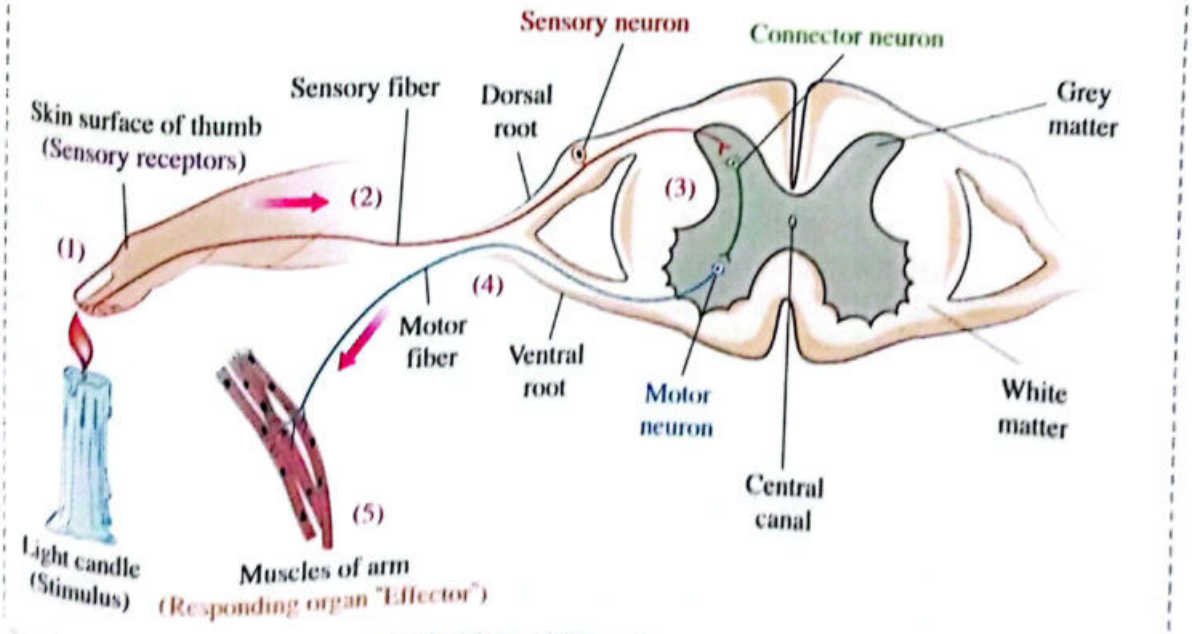
"In most cases"

- **Sense organ** — **Receptor**
- **Sensory neuron** — **Afferent**
- **Connector neuron** — **Intermediate**
- **Motor neuron** — **Efferent**
- **Responding organ** — **Effector**

It is the organ that responds to the changes that happened in the environment, such as muscles and glands.

## Types of reflex arc

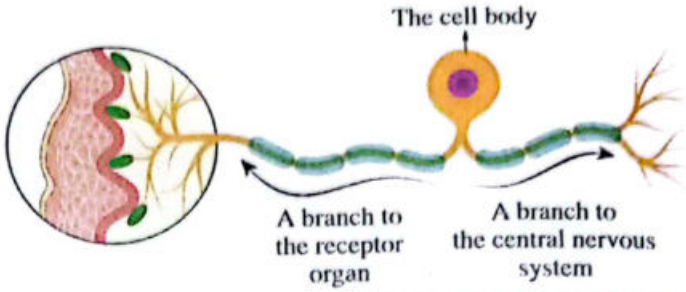
1. **Voluntary (Somatic) reflex arc :** The response is in the voluntary (skeletal) muscles.
2. **Involuntary (Autonomic) reflex arc :** The response is in the involuntary muscles (like cardiac muscle) or glands.




Mechanism of the reflex action

## Key Points

- The connector neurons are completely found inside the grey matter.
- The sensory neurons are nerve cells with one axon that branches at short distance from the cell body into two branches, where one of them is long and ends with structures resemble dendrites and directs towards the receptor organ and the other is short and directs towards the central nervous system.

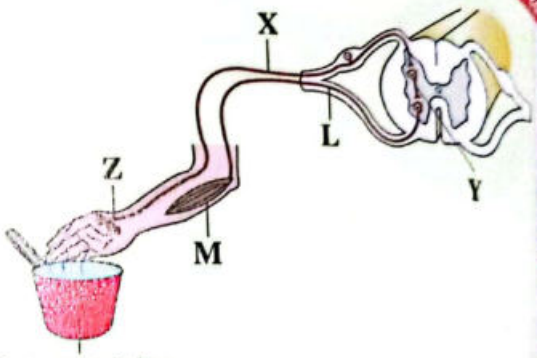



## 2 Test yourself

**1** Choose the correct answer :

The opposite figure represents a reflex arc, which of the following represents the correct arrangement for the transmission of nerve impulse ?

(a) L ⟶ Y ⟶ X ⟶ Z ⟶ M
(b) Y ⟶ L ⟶ Z ⟶ X ⟶ M
(c) Y ⟶ X ⟶ L ⟶ Z ⟶ M
(d) Z ⟶ X ⟶ Y ⟶ L ⟶ M




**2** Give reason for : the leg movement when hitting beneath the human knee by using a medical hammer.

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## Autonomic nervous system

- **Function :**
  It regulates the different involuntary activities (that don't obey the human will), such as :
  - Regulating the contraction movement of the cardiac muscles and smooth (involuntary) muscles
  - Secretion of the body glands.
- **The autonomic nervous system consists of :**

### 1 Sympathetic nervous system :

- Its nerve fibers **arised** from the thoracic and lumbar regions of the spinal cord.
- **Function :** it acts as the emergency system, where the nerve impulses that are carried by this system, control many of the internal body organs, causing some changes to them that enable the body to face the emergency situations.

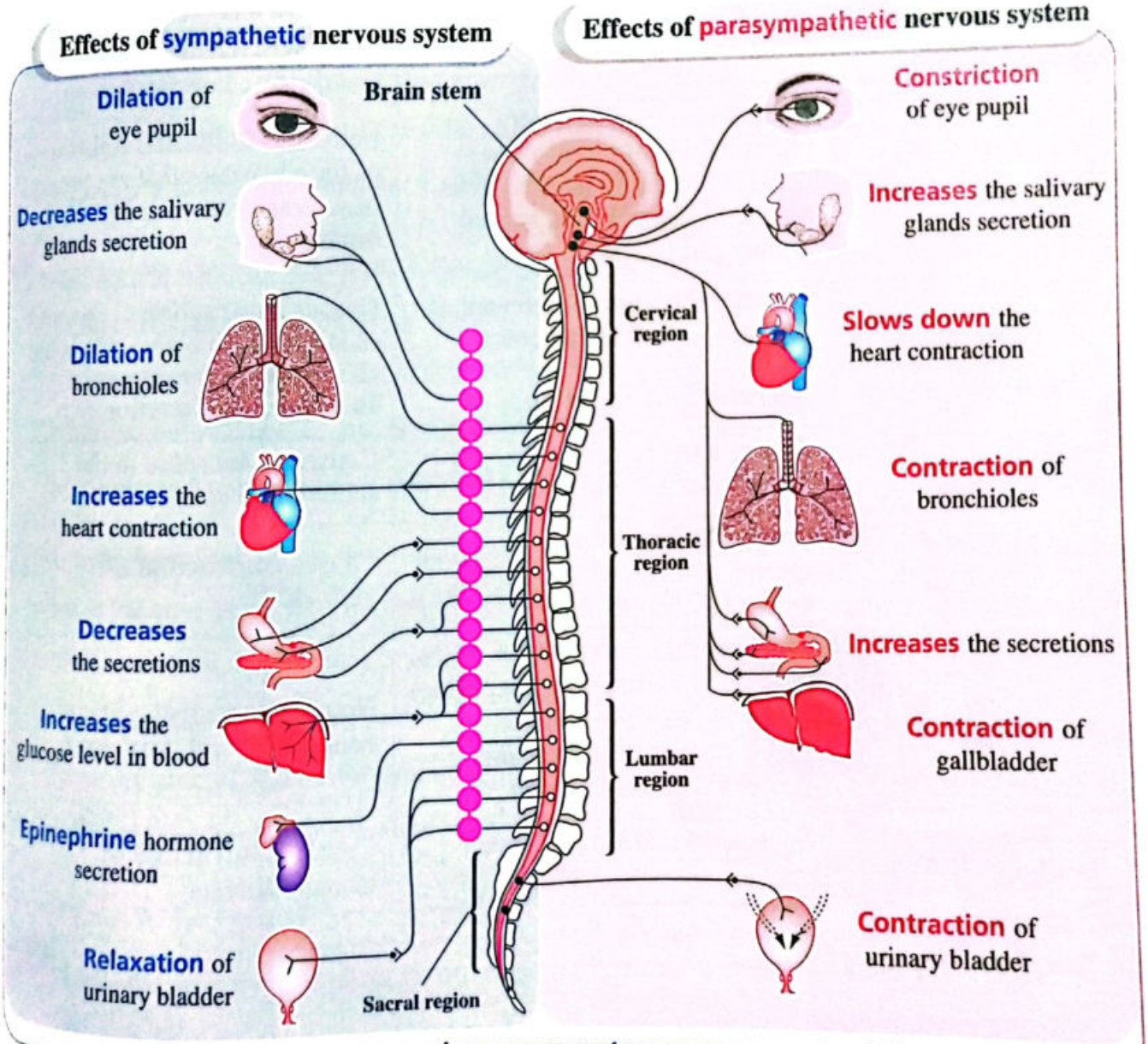
### ② Parasympathetic nervous system :

- Its nerve fibers **arised** from the brain stem and sacral region of the spinal cord.

**Do you know... ?**

- The brain stem (Truncus encephali) consists of the midbrain, Pons Varolii and medulla oblongata.

- Most of the internal body parts receive nerve fibers from both the sympathetic and parasympathetic systems, and in most cases the effect of one system antagonizes the effect of the other system, **as shown in the following figure and table :**




**Different effects of autonomic nervous system on some parts of the body**

| Effector organ \ Autonomic nervous system | Effect of sympathetic nervous system | Effect of parasympathetic nervous system |
|---|---|---|
| Eye : | Causes **dilation** of eye pupil. | Causes **constriction** of eye pupil. |
| Salivary glands : | Causes a **decrease** in the secretion of saliva. | Causes an **increase** in the secretion of saliva. |
| Respiratory system : | Causes **dilation** (relaxation) of bronchioles and decreases their secretions. | Causes **constriction** (contraction) of bronchioles and increases their secretions. |
| Heart : | **Increases** the heartbeats rate and the force of contraction. | **Decreases** the heartbeats rate and the force of contraction. |
| Blood vessels : | Causes **vasoconstriction** (contraction) of blood vessels that are present in skin, viscera, salivary glands, brain, genital organs and lungs. | Causes **vasodilation** (relaxation) of blood vessels that are present in salivary glands and genital organs. |
| Alimentary canal : | Causes **relaxation** of the wall of stomach, intestine and colon. | Causes **contraction** of the wall of stomach, intestine and colon. |
| Gastric glands : | **Decreases** the secretion. | **Increases** the secretion. |
| Pancreas : | Causes a **decrease** in the secretion of enzymes. | Causes an **increase** in the secretion of enzymes. |
| Liver : | Causes the **breakdown** of glycogen, therefore the glucose level in blood increases. | Causes **contraction** of gallbladder. |
| Medulla of the adrenal gland : | Stimulates the **secretion** of adrenaline hormone (epinephrine) which increases the blood pressure, heartbeats rate and the glucose level in blood. | **No** parasympathetic fibers connection with this gland. |
| Urinary bladder : | Causes **relaxation** of urinary bladder. | Causes **contraction** of urinary bladder. |

## 3 Test yourself

**Choose the correct answer :**

1 Which of the following regions in the spinal cord, from which the fibers of autonomic nervous system **don't** emerge ?

(a) Cervical. (b) Thoracic. (c) Lumbar. (d) Sacral.

2 From which of the following regions the autonomic nerve fiber that causes the constriction of eye pupil emerged ?

(a) Sacral. (b) Thoracic. (c) Cervical. (d) Brain stem.

Chapter 5

Questions on Lesson Five

# Peripheral Nervous System

Use the App GPS

The questions signed by * are answered in detail. Understand Apply Analyze

Interactive test

## First Multiple Choice Questions

1 If you know that the number of vertebrae of the vertebral column is 33, what is the relation between this number and the number of the following nerves pairs ?

(a) It is lower than the number of spinal nerves pairs.

(b) It is equal to the number of spinal nerves pairs.

(c) It is equal to the number of cranial nerves pairs.

(d) It is greater than the number of spinal nerves pairs.

2 What are the nervous structures found in the $10^{th}$ spinal nerve and spinal cord together ?

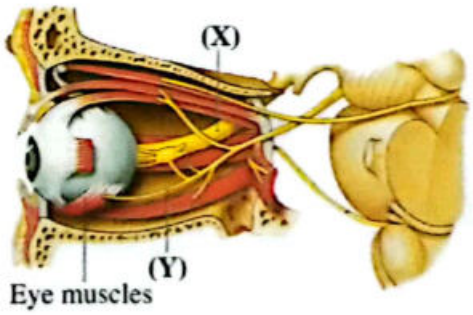
(a) Glial cells and motor neurons' bodies.

(b) Nerve fibers and glial cells.

(c) Motor neurons' bodies and nerve axons.

(d) Connector neurons' bodies and glial cells.

3 From the following figure that illustrates the connecting nerves between eye and brain, what is the type of nerves (X) and (Y) respectively ?




(a) Mixed cranial and sensory cranial.

(b) Mixed spinal and motor cranial.

(c) Sensory cranial and motor cranial.

(d) Mixed spinal and mixed cranial.

4 Which of the following is absent from the simplest reflex arc ?

(a) Sensory neuron.

(b) Motor neuron.

(c) Connector neuron.

(d) Responding organ.

5 Which of the following neurons whose body **isn't** present in the grey matter of spinal cord ?

(a) Neuroglia.

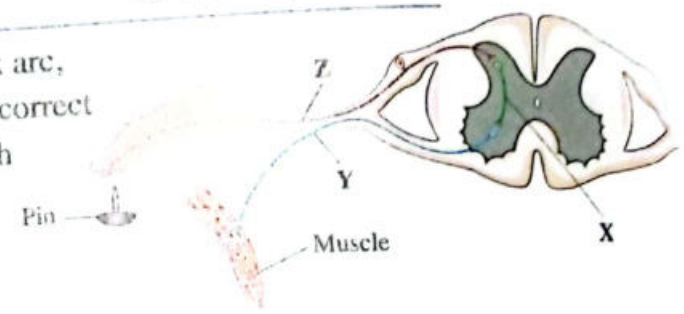
(b) Motor neuron.

(c) Connector neuron.

(d) Sensory neuron.

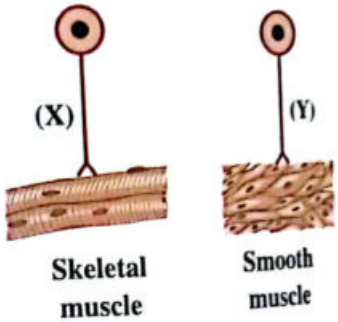
6 In the reflex arc, which of the following are connected to the terminal arborizations of the connector neuron ?
(a) The dendrites and cell body of sensory neuron.
(b) The dendrites and cell body of motor neuron.
(c) The sensory receptor.
(d) The responding organ.

7 The opposite figure represents a reflex arc, which of the following represents the correct arrangement of neurons through which the nerve impulse passes ?




(a) X ⟶ Y ⟶ Z
(b) Y ⟶ Z ⟶ X
(c) Y ⟶ X ⟶ Z
(d) Z ⟶ X ⟶ Y

8 Study the opposite figure, then answer :



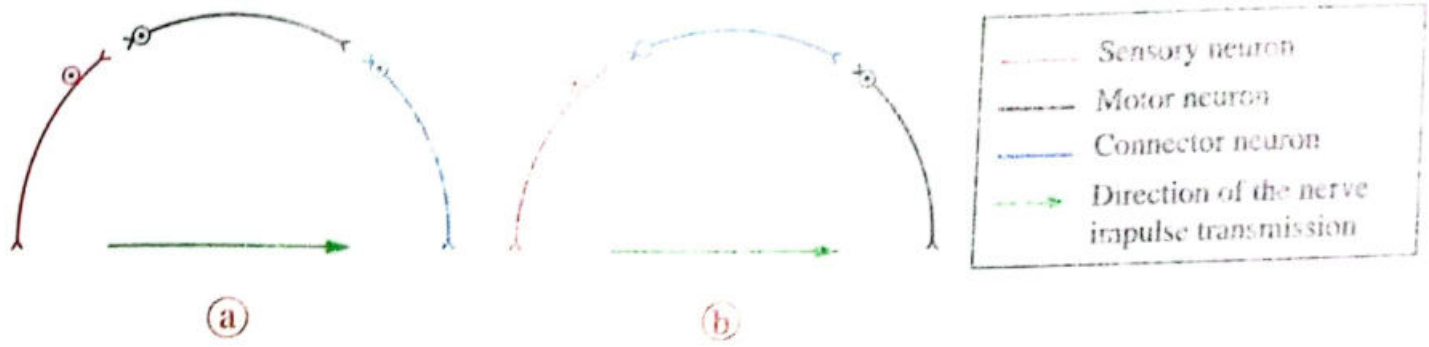

(1) Which of the following statements is correct ?
(a) (X) is a neuron and (Y) is a motor neuron.
(b) (X) and (Y) are sensory neurons.
(c) (X) is a motor neuron and (Y) is a sensory neuron.
(d) (X) and (Y) are motor neurons.

(2) Which of the following statements is correct ?
(a) (X) causes a voluntary movement and (Y) causes an involuntary movement.
(b) (X) causes an involuntary movement and (Y) causes a voluntary movement.
(c) (X) and (Y) cause a voluntary movement.
(d) (X) and (Y) cause an involuntary movement.

9 When a person accidentally touches a hot teapot, that is near to him, he pulls his hand fastly, but he feels pain later, study the following statements, then answer :
(1) The stimulus reaches the brain first, then to the spinal cord.
(2) The hand pulling is under control the spinal cord.
(3) Before the temperature stimulus reaches the cerebral cortex, it passes through thalamus.
Which of the previous statements is correct ?
(a) (1) and (2). (b) (1) and (3). (c) (2) and (3). (d) (3) only.

10 What is the reason for no pulling the person his arm when being injected by a medicine ?
(a) Feeling no pain.
(b) Delaying the nerve impulse that passes to the spinal cord.
(c) Damaging the neural receptors in skin.
(d) Preventing the muscle response to the reflex action.

**11** Which of the following diagrammatic figures shows the correct sequence of the neurons that form the reflex arc ?




(a) (b)

(c) (d)

---

**12** The opposite figure represents a neuron, which of the following choices can be present at **(X)** and **(Y)** respectively ?


(a) Intestine / Brain.
(b) Spinal cord / Gland.
(c) Hand / Eye.
(d) Leg muscle / Spinal cord.

---

**13** Contraction occurs suddenly, when a hand touches a hot surface, which of the following control(s) this action ?

(a) Spinal cord.
(b) Parietal lobe of the cerebral cortex.
(c) Involuntary muscles.
(d) Voluntary muscles.

---

**14** Inside the grey matter of spinal cord, the dendrites of neurons cell bodies are present, which of the following represent these cells ?

(a) Sensory and connector.
(b) Sensory and motor.
(c) Motor and connector.
(d) Sensory, motor and connector.

---

**15** Which of the following neurons totally exist inside the central nervous system ?

(a) Connector neurons only.
(b) Motor neurons only.
(c) Sensory and connector neurons.
(d) Sensory and motor neurons.

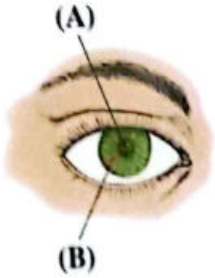
16 Which of the following parts of reflex arc are found outside the grey matter of spinal cord ?

(a) Connector neurons' bodies.
(b) Sensory neurons' bodies.
(c) Motor neurons' bodies.
(d) Connector neurons' fibers.

17 Which of the following systems is activated during relaxation ?

(a) Sympathetic.
(b) Parasympathetic.
(c) Autonomic.
(d) Peripheral.

18 The opposite figure represents an eye of a person that was exposed to a bright light, what happens to the distances (A) and (B) respectively, when he moves to a room with dim light ?




(a) Increases / Decreases.
(b) Decreases / Doesn't change.
(c) Decreases / Increases.
(d) Doesn't change / Decreases.

19 From which of the following regions are the nerve fibers that act on the contraction of gallbladder arisen ?

(a) Thoracic region of the spinal cord.
(b) Lumbar region of the spinal cord.
(c) Brain stem region.
(d) Sacral region of the spinal cord.

20 Which of the following **doesn't** obey the autonomic nervous system effect, when a person faced a terrifying situation ?

(a) The relaxation of stomach muscles.
(b) The contraction of lungs' blood vessels.
(c) The relaxation of urinary bladder muscles.
(d) The contraction of bronchioles.

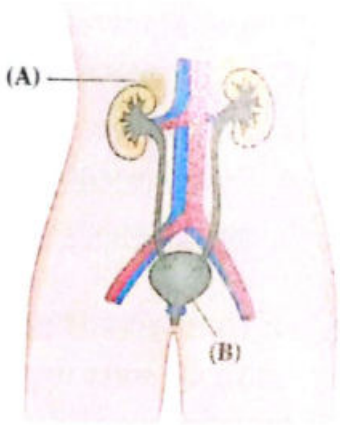
21 What happens for the secretion of saliva when feeling fear ?

(a) It increases.
(b) It decreases.
(c) It stops.
(d) It is not affected.

22 From which of the following regions are the nerve fibers that act on increasing the heart contraction emerged ?

(a) The thoracic region of spinal cord.
(b) The lumbar region of spinal cord.
(c) The brain stem region.
(d) The sacral region of spinal cord.

23 The opposite figure shows the urinary system in human :




(1) What is the region from which the nerve fibers are arisen that cause the secretion of adrenaline hormone from structure (A) ?

ⓐ Cervical region.
ⓑ Thoracic region.
ⓒ Lumbar region.
ⓓ Sacral region.

(2) What is the region from which the fibers that cause the expelling of the liquid in structure (B) out ?

ⓐ Cervical region.
ⓑ Thoracic region.
ⓒ Lumbar region.
ⓓ Sacral region.

---

24 What is the effect of parasympathetic nervous system activity on the digestion process ?

ⓐ Accelerated. ⓑ Inhibited. ⓒ Stopped. ⓓ Not affected.

---

25 What is the nervous system that leads to the non-contraction of the urinary bladder, when a damage occurs in a type of its fibers ?

ⓐ Sympathetic nervous system in sacral region.
ⓑ Parasympathetic nervous system in sacral region.
ⓒ Sympathetic nervous system in lumbar region.
ⓓ Parasympathetic nervous system in lumbar region.

---

26 From which of the following are the nerve fibers that act on increasing the salivary glands secretion emerged ?

ⓐ The thoracic region of spinal cord.
ⓑ The lumbar region of spinal cord.
ⓒ The brain stem region.
ⓓ The sacral region of spinal cord.

---

27 * To which type of cells does the following cell belong ?

ⓐ Motor neurons.
ⓑ Connector neurons.
ⓒ Sensory neurons.
ⓓ Neuroglia.

29 ✻ What happens when the dorsal root of a spinal nerve is cut ?

(a) The connected sensory receptor to this root remains working.

(b) The connected sensory receptor to this root loses the sensation.

(c) The movement of the muscle connected to the ventral root will vanish.

(d) The connected muscle to the ventral root will remain responding reflectively.

---

28 ✻ The opposite figure represents a neuron in which the nerve impulse passes, which of the following choices describes the type of this cell and the direction of nerve impulse respectively ?

(a) Motor / To the spinal cord.

(b) Motor / Away from the spinal cord.

(c) Sensory / To the spinal cord.

(d) Sensory / Away from the spinal cord.

---

30 ✻ If a driver was subjected to an accident in which his arm was injured, and after transporting him to the hospital, he told the doctor that he can feel his hand, but he couldn't move it. What are your recommendations that may help the doctor in the initial diagnosis in case of the absence of any fractures ?

(a) The damage of receptors in the hand.

(b) The damage of nervous link between the hand receptors and the central nervous system.

(c) The damage of nervous link between the central nervous system and the responding organ.

(d) The damage of both links in (b) and (c) together.

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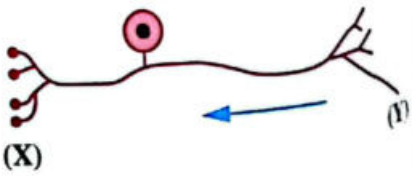
31 ✻ The opposite figure represents a neuron, which of the following parts may be present at (X) and (Y) respectively ?




(a) Terminal arborizations of connector neuron / Thumb.

(b) Cell body of connector neuron / Thumb.

(c) Thumb / Terminal arborizations of connector neuron.

(d) Thumb / Cell body of connector neuron.

---

32 ✻ Which choice in the following table illustrates the effect of adrenaline hormone ?

| | Blood pressure | Level of glucose | The rate of heartbeats |
|---|---|---|---|
| (a) | Increases | Decreases | Increases |
| (b) | Decreases | Increases | Increases |
| (c) | Increases | Increases | Increases |
| (d) | Increases | Increases | Decreases |

33 ✱ A person saw a tiger suddenly, his nervous system would respond to this situation through the activity of the autonomic nerve fibers that are arisen from the spinal cord, from which of the following regions are those fibers arisen ?

(a) The brain stem region.
(b) The thoracic and lumbar regions.
(c) The sacral region.
(d) The brain stem and thoracic regions.

34 ✱ Which of the following expresses the effect of sympathetic and parasympathetic nervous system on the heart ?

(a) Symmetric.
(b) Opposite to each other.
(c) Complementary.
(d) Successive.

35 ✱ When eating a meal containing carbohydrates and meats during watching a horror movie, what is the effect of that on the rate of digestion process ?

(a) Increases in mouth and stomach.
(b) Decreases in mouth and stomach.
(c) Decreases in mouth and increases in stomach.
(d) Increases in mouth and decreases in stomach.

## Second Miscellaneous Questions

1 **Compare between :** cranial nerves and spinal nerves, "**according to :** their number – types".

2 **Explain :** the reflex action doesn't need the brain interference.

3 **Compare between :** the central nervous system and peripheral nervous system, "**according to :** the function".

4 **Explain :** when a hand is exposed to a prickle by pin or touched a hot surface, the sensation of pain occurs after withdrawing the hand with a very short time.

5 "The parasympathetic nervous system acts on increasing the level of glucose in blood". **How far is this statement correct ? With explanation.**

6 **Give reason for :** the contraction of eye pupil, when it is exposed to a bright light.

7 "The nerve fibers that act on the contraction and relaxation of urinary bladder arised from the same region of the spinal cord". **How far is this statement correct ? With explanation.**

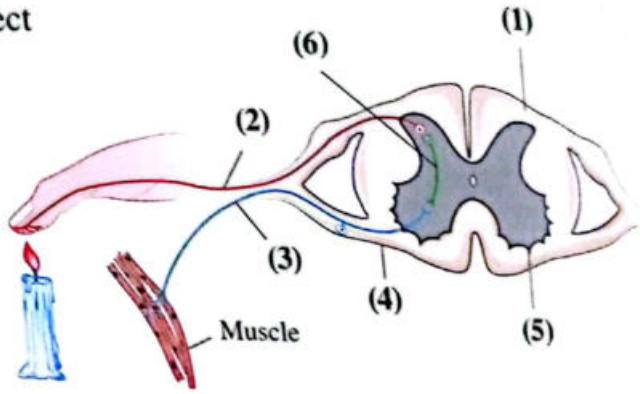
8 **Explain how :** the sympathetic nervous system deals with the sudden decrease in blood pressure.

## Questions that measure **high levels of thinking**

Answered in detail

### Choose the correct answer :

**1** Which of the following can be changed in the opposite figure to become a scientifically correct reflex arc ?




(a) Placing the direction of cell body no. (2) at the finger position.

(b) Placing the terminals of cell no. (3) at the position of the muscle.

(c) Placing the cell body no. (6) at the position of its terminals and vice versa.

(d) Replacing cell no. (3) with cell no. (2).

**2** Which of the following parts their actions are complementary with the action of the occipital lobe to perform the work of eyes as a sense organ ?

(a) Hindbrain and autonomic nervous system.

(b) Midbrain and forebrain.

(c) Hindbrain and peripheral nervous system.

(d) Midbrain and peripheral nervous system.

**3** Which of the following has/have **no** role in the action of respiratory system ?

(a) Nervous centres in medulla oblongata.

(b) Nerves between cervical and lumbar vertebrae.

(c) The frontal lobe.

(d) Nerves from the brain stem.

**4** One of the treatment methods of bronchial asthma is the effect on the nervous system. what is the effect of drugs that treat this case ?

(a) Activation of sympathetic nervous system.

(b) Inhibition of sympathetic nervous system.

(c) Activation of the two types of autonomic nervous system.

(d) Inhibition of the two types of autonomic nervous system.

Test on Chapter 5

# Sensitivity in Living Organisms

**Choose the correct answer (1 : 20) :**

1 Which of the following statements **isn't** correct about the nervous system ?

ⓐ The nerve consists of uncoated nerve bundles.

ⓑ The nerve fibers group is coated with connective tissue.

ⓒ The nerve is supplied with a group of blood vessels.

ⓓ The nerves may be sensory, motor or mixed.

2 If you are writing an article, which of the following lobes will be the most active in brain ?

ⓐ The frontal and occipital lobes.

ⓑ The parietal and temporal lobes.

ⓒ The temporal and occipital lobes.

ⓓ The frontal and $5^{th}$ lobes.

3 * Which of the following parts whose cells are greatly elongated, due to the shortage of auxins from this part ?

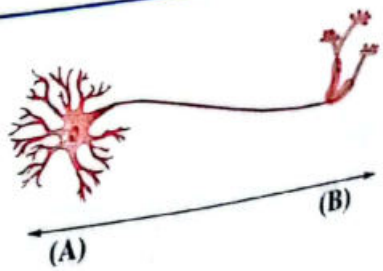
ⓐ The side of stem facing light.

ⓑ The side of root facing water.

ⓒ The lower side of stem in a horizontal position.

ⓓ The upper side of root in a horizontal position.

4 The opposite figure illustrates a neuron without myelin sheath, in which direction does the nerve impulse transmit and what is its speed ?




ⓐ From (A) to (B) more quickly.

ⓑ From (B) to (A) more quickly.

ⓒ From (A) to (B) at a lower speed.

ⓓ From (B) to (A) at a lower speed.

5 What is the reason that makes the potential difference on the two sides of the nerve fiber membrane equals (–70 mV) ?

(a) Increasing the permeability of ($K^+$) to outside.
(b) The opening of ($Na^+$) channels that are present in the fiber membrane.
(c) The occurrence of nerve impulse.
(d) The isolation by Schwann cells.

6 What is the result of the exposure of a plant root to light from one side and to water from the other side ?

(a) The growth of root horizontally.
(b) Promoting the hydrotropism of root.
(c) The positive phototropism of root.
(d) The stopping of root growth.

7 Which of the following choices is applied to the peripheral and autonomic nervous systems ?

(a) The first system is a part of the second system.
(b) The second system is a part of the first system.
(c) The first system is completely voluntary and the second system is involuntary.
(d) Each one of them works separately from the central nervous system.

8 Which of the following statements agrees with the refractory period ?

(a) The movement of sodium and potassium ions remains constant through it.
(b) The nerve cell can't transmit a new nerve impulse during it.
(c) It is completely similar to the time of rest of nerve cell.
(d) The number of ADP molecules decreases during it.

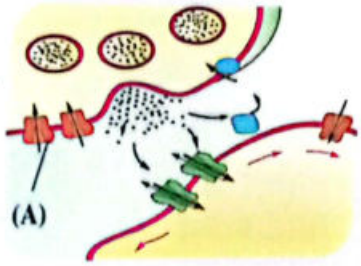
9 Which of the following **isn't** controlled by the sympathetic part of the autonomic nervous system ?

(a) The relaxation of bronchioles in the two lungs.
(b) The decrease of urination rate.
(c) The increase of heartbeats rate.
(d) The stimulation of salivary glands secretion.

10 While a policeman was chasing a thief, he hit him on the back of his head to be able to arrest him, that led to the disruption of his balance and falling to the ground, which of the following parts do you expect to be affected by that ?

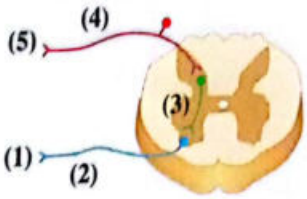
(a) Medulla oblongata.
(b) Cerebellum.
(c) Thalamus.
(d) Hypothalamus.

11 In the opposite figure, what is the role of structure (A) ?




(a) Releasing the acetylcholine from the synaptic vesicles.
(b) Starting the stimulation of the postsynaptic membrane.
(c) Ending the role of neurotransmitters in stimulating the postsynaptic membrane.
(d) The entry of calcium ions to the presynaptic membrane.

12 The opposite figure represents a reflex arc, which of the following represent the numbers from (1) : (5) respectively ?




(a) Sense organ / Afferent cell / Connector cell / Efferent cell / Responding organ.
(b) Sense organ / Efferent cell / Connector cell / Afferent cell / Responding organ.
(c) Responding organ / Afferent cell / Connector cell / Efferent cell / Sense organ.
(d) Responding organ / Efferent cell / Connector cell / Afferent cell / Sense organ.

13 Where is the dura mater present ?

(a) Beneath the skull bones and pia mater.
(b) Beneath the skull bones and above the arachnoid.
(c) Above the pia mater and beneath the arachnoid.
(d) Beneath the skull bones and the arachnoid.

14 * Which of the following is from the functions of neuroglia ?

(a) They link a nerve cell with another at the synapse.
(b) They coat the groups of nerve bundles.
(c) They provide the axons of nerve cells with myelin substance.
(d) They act as a link between the efferent and afferent cells of the central nervous system.

15 Which of the following agrees with the two types of autonomic nerve fibers that affect the muscles of the urinary bladder ?

(a) They work together at the same time.
(b) They are emerged from the same region of the spinal cord.
(c) They differ in their action, according to the region of spinal cord from which they are emerged.
(d) They are related to the brain stem.

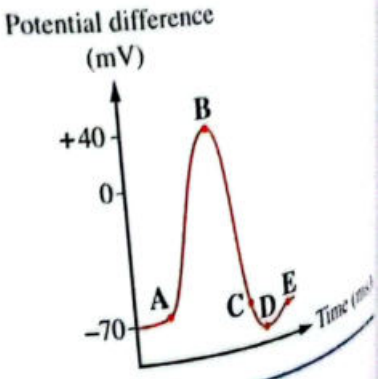
16 ✻ The opposite figure shows the lower surface of brain, what is the number of the appeared lobes of cerebral cortex ?

(a) 2 (b) 4
(c) 5 (d) 10

17 If you know that the knee joint has an important role in the movement of leg bones that enables the human to move, in *Mimosa* plant, which of the following whose action is similar to the action of each of knee joint and leg bones respectively ?

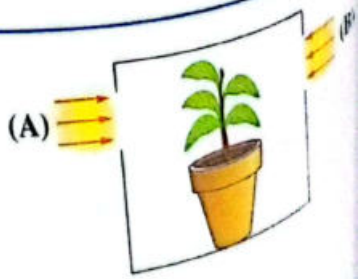
(a) Primary rachises and primary pulvini of the leaflets.
(b) Secondary rachises and secondary pulvini of the leaflets.
(c) Pulvini of the leaflets' bases and secondary rachises of the leaflets.
(d) Primary pulvini and primary rachises of the leaflets.

18 The opposite graph illustrates the stages passed by a nerve cell that was exposed to a stimulus, which stage represents the repolarization ?




(a) A ⟶ B (b) B ⟶ C
(c) C ⟶ D (d) D ⟶ E

19 The opposite figure illustrates a plant inside a box with two lateral holes, what happens to the plant stem after passing several days ?




(a) It bends towards the light source (A).
(b) It bends towards the light source (B).
(c) It bends towards (A) or (B) and this is determined by the difference in the concentration of auxins.
(d) It grows vertically and doesn't bend.

**20** Which of the following doesn't affect the speed of nerve impulse transmission ?

ⓐ The increase in the nerve fiber diameter.

ⓑ The presence of myelin sheath.

ⓒ The increase in the stimulus strength.

ⓓ The presence of neuroglia.

**Answer the following questions (21 : 23) :**

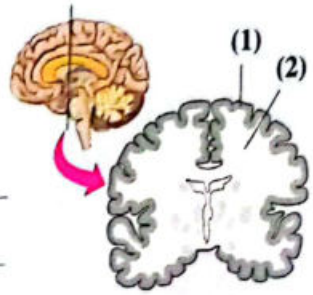
**21** **Explain how :** the autonomic nervous system affects the digestion process in a person who has just finished eating his meal and set for relax.

**22** "The nerve impulse consumes a larger amount of energy during its transmission through the non-myelinated neural axons, comparing with the transmission of another nerve impulse having the same strength through the myelinated nerve axons".

**How far is this statement correct ? With explanation.**

**23** **The opposite figure illustrates a section in the cerebral cortex :**

**From which** no. (1) and (2) are formed ?



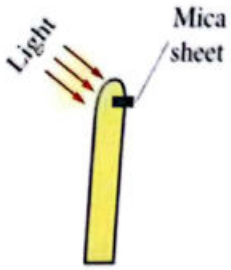
# Monthly Tests

(According to the Standards of the Ministry of Education)

# Test 1 On the First Month

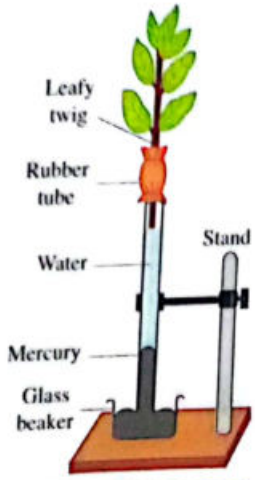
**Choose the correct answer (1 : 8) :**

**1** From the opposite figure, what happens to the seedling if the mica sheet is replaced by gelatine ?




(a) It curves towards the light direction.
(b) It curves away from light.
(c) It grows straightly.
(d) Its growth stops.

**2** From the opposite figure, what do you expect to happen for the level of mercury in the tube, in the summer morning in case of increasing each of temperature and the number of plant leaves respectively ?

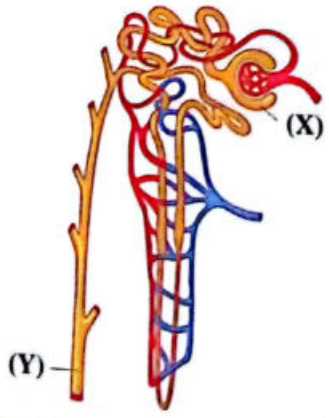



(a) Increases / Not affected.
(b) Increases / Increases.
(c) Not affected / Not affected.
(d) Not affected / Increases.

**3** Which of the following is correct about the protein percentage in the renal vein compared to the renal artery in normal cases ?

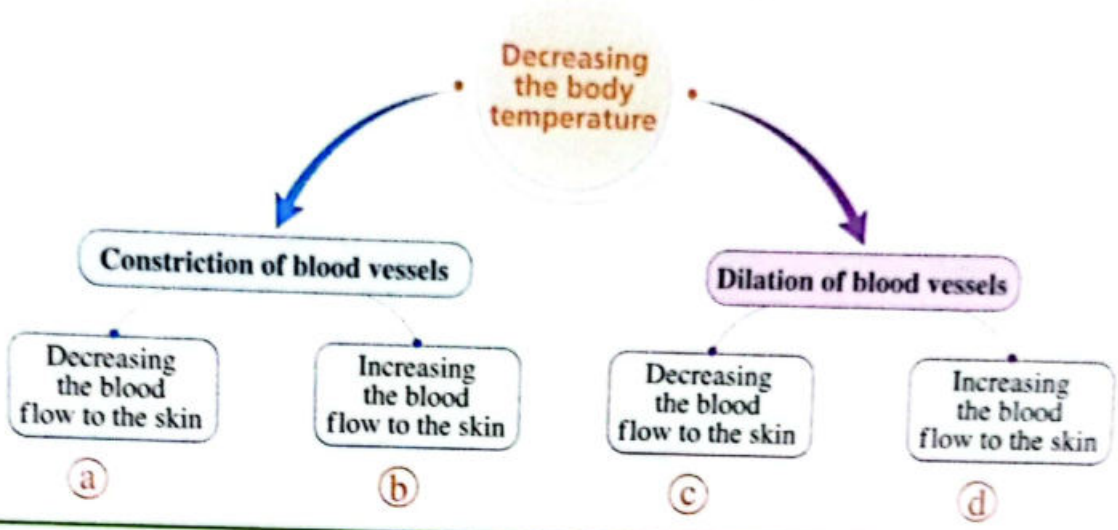
(a) Less than.
(b) More than.
(c) Equal.
(d) There is no relation.

**4** Which of the following characterizes the fluid that is present in structure (X) from the fluid that is present in structure (Y) ?




(a) The absence of red blood cells.
(b) The presence of glucose.
(c) The absence of protein.
(d) The presence of urea.

**5** The following diagram has many paths, which of them illustrates the response of the blood vessels in the skin on decreasing the body temperature ?




**6** If you know that creatinine substance is one of the nitrogenous wastes of the metabolism process that the muscles perform, and the kidneys get rid of it normally from the body, if the normal range of creatinine in a healthy person ranges between (0.7 : 1.2 mg/dL). While in the kidney failure patient, it reaches above 4 mg/dL, which of the following represents the creatinine concentration in the purifying liquid in the artificial kidney device ?

(a) 1.2 mg/dL. (b) 0.7 mg/dL. (c) 4 mg/dL. (d) 0.0 mg/dL.

**7** Which of the following statements **isn't** applied to the plant in the opposite figure ?

(a) It responds to the light stimulus.
(b) Its response resemble the response of *Mimosa* plant to touch.
(c) It contains green plastids.
(d) It has a specialized sensation system.

**8** Which of the following substances is(are) **not** found in the sweat ?

(a) Water. (b) Sodium salts. (c) Urea. (d) Glucose.

**Answer the following questions (9 & 10) :**

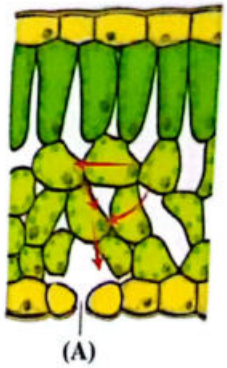
**9** **Explain** : the root system and the vegetative system in plant share in the excretion of some substances.

**10** **Compare between** : sweat gland and nephron, "**according to** : the function".

# Test 2 On the First Month

**Choose the correct answer (1 : 8) :**

**1** The opposite figure illustrates a type of transpiration in the plant. What happens to the transpiration rate on the absence of structure (A) from the leaves ?



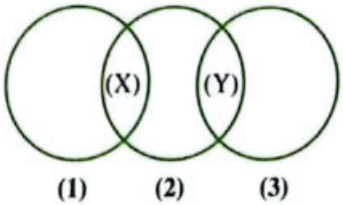

(a) Decreases.

(b) Increases.

(c) Not affected.

(d) Vanishes.

**2** The opposite figure illustrates three excretory organs in the human body, if you know that organ no. (1) has a role in the respiration process, organ no. (3) has a role in the digestion process, what do the excretory substances (X), and (Y) represent respectively ?




(a) Nitrogenous wastes / Water.

(b) Water / Spices.

(c) Spices / Poisonous substances.

(d) Poisonous substances / Nitrogenous wastes.

**3** The following table illustrates four urine samples and the lost amount of sweat for a person in different weather days, which sample in the following table was collected in a hot day ?

| | Sweat volume ($cm^3$) | Urine volume ($cm^3$) |
|---|---|---|
| (a) | 1.5 | 0.8 |
| (b) | 0.8 | 0.8 |
| (c) | 0.8 | 1.5 |
| (d) | 1.1 | 1.2 |

**4** Which of the following statements agrees with the excretion in plant ?

(a) As the photosynthesis rate increases, the transpiration rate decreases.

(b) The hydathodes open and close continuously.

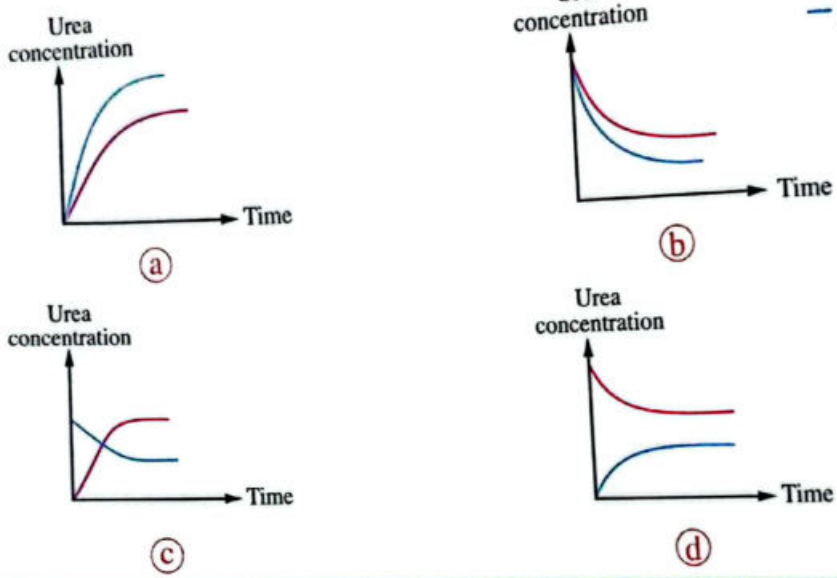
(c) The transpiration process stops in the trees with fallen leaves in winter.

(d) The excretion rate is related to the catabolic rate.

**5** Which of the following graphs shows the rate of change in urea level in each of the purifying liquid and the passing blood with timing ?

— Urea concentration in the purifying liquid

— Urea concentration in the patient's blood




ⓐ ⓑ ⓒ ⓓ

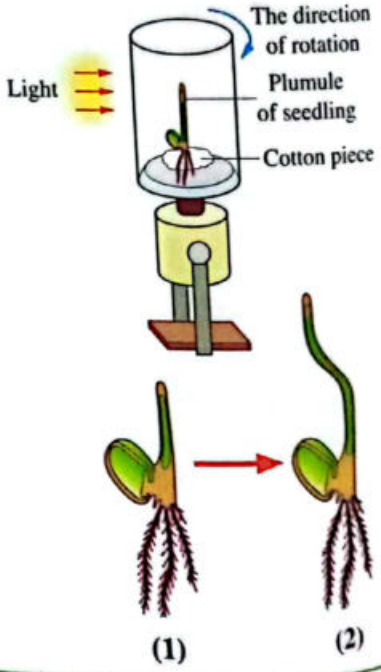
**6** The opposite figure illustrates an apparatus used to prove the tropism, what is the procedure through which the plumule of seedling no. (1) grows to be as figure no. (2), when fixed as in this apparatus ?

ⓐ Rotating the seedling for two days and fixing it another two days.

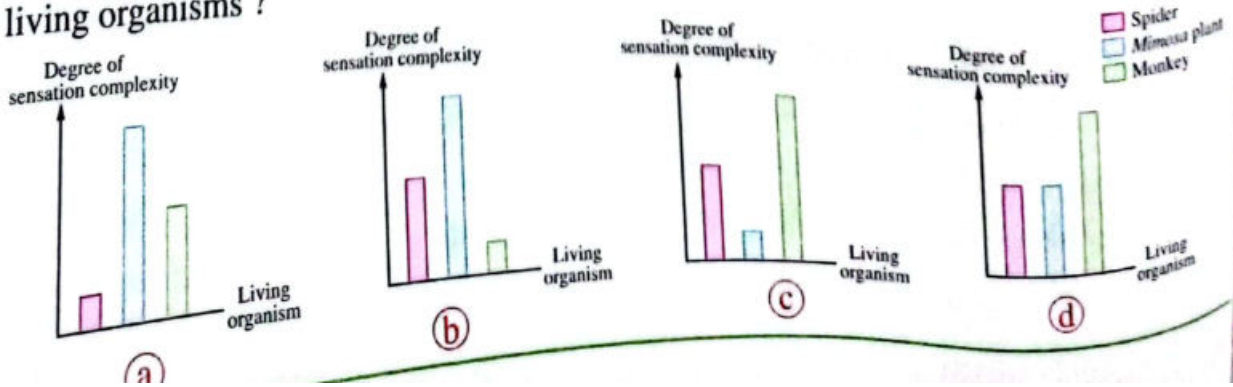
ⓑ Fixing the seedling for two days and rotating it another two days.

ⓒ Rotating the seedling for four days.

ⓓ Fixing the seedling for four days.




**7** Which of the following graphs expresses the degree of sensation complexity for three living organisms ?




ⓐ ⓑ ⓒ ⓓ

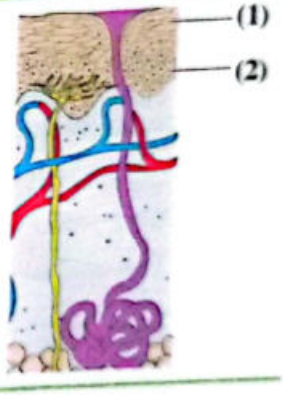
8 In which of the following organisms are the two kidneys present in the form of long and thin organs ?

(a) Whale. (b) Frog. (c) Bat. (d) Elephant.

**Answer the following questions (9 & 10) :**

9 "There is no relation between the constancy of the blood content and the kidney function". **How far is this statement correct ? With explanation.**

10 The opposite figure illustrates a part from a section in the human skin, **what** is the relation between the two structures (1) and (2) ?



# Test 1 On the Second Month

**Choose the correct answer (1 : 8) :**

**1** What is the value of the action potential that resulted from strong stimulus compared to the stimulus that has lower strength, if both of them are sufficient for stimulation ?

(a) Double. (b) Higher. (c) Lower. (d) Equal.

**2** Which of the following represents the change occurred in the environment that makes the nervous system respond with a certain way ?

(a) Stimulus. (b) Response. (c) Receptor. (d) Sensation.

**3** Which of the following represents the role of Schwann cells in the transmission of nerve impulse ?

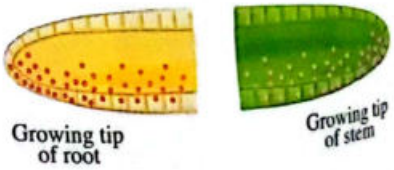
(a) They nourish the axons of neurons.
(b) They decrease the speed of nerve impulse.
(c) They increase the speed of nerve impulse. (d) They protect the nerve cell.

**4** According to the values of the ions illustrated in the following table, what is the state of this cell ?

(a) Rest state.
(b) The end of the depolarization state.
(c) The beginning of repolarization state.
(d) Increasing the polarization.

| | Inside the neuron | Outside the neuron |
|---|---|---|
| $Na^+$ | 15 mM | 145 mM |
| $K^+$ | 150 mM | 5 mM |

**5** The following figure illustrates the accumulation of auxins in the growing tip for each of the root and stem in a horizontal position. What is the expected result in both states ?

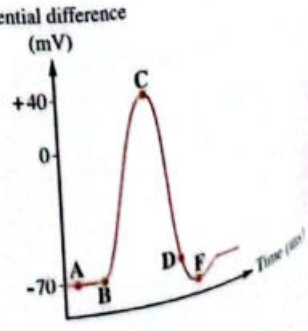



(a) Inhibiting the elongation of cells on the two sides which are free from auxins.
(b) Activating the elongation of cells on the two sides which are free from auxins.
(c) The curvature of each of the two tips in the same direction.
(d) The curvature of each of the two tips in an opposite direction to the other.

**6** The following graph illustrates the stages through which the nerve cell passes, when it is exposed to stimulation, where :

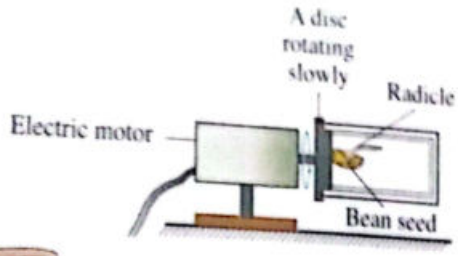
- **(AB) :** polarization stage. - **(BC) :** depolarization stage.
- **(CD) :** repolarization stage. - **(DF) :** increasing polarization.

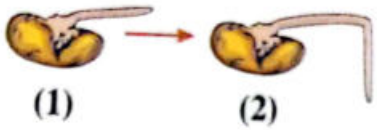
In which of the following stages the positive ions exceed the negative ions inside the nerve cell ?




(a) The beginning of the depolarization stage and the end of the repolarization stage.
(b) The end of the depolarization stage and the beginning of the repolarization stage.
(c) The beginning of depolarization stage and increasing the polarization stage.
(d) The polarization stage and the beginning of repolarization stage.

7 The opposite figure illustrates an apparatus used to prove the tropism, what is the procedure through which the radicle of seed no. (1) grows, in order to be as figure no. (2) on fixing the seed as in this apparatus ?



(1) (2)

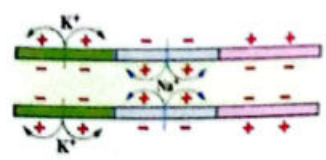
(a) Rotating the seed for two days and fixing it for the next two days.
(b) Fixing the seed for two days and rotating it for the next two days.
(c) Rotating the seed for four days.
(d) Non-rotating the seed for four days.

8 Which of the following organelles characterize(s) the glial cells from the nerve cells ?

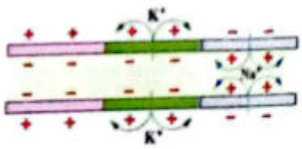
(a) Mitochondria. (b) Nissl's granules. (c) Centrosome. (d) Nucleus.

**Answer the following questions (9 & 10) :**

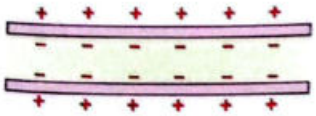
9 **Arrange** the following stages of the nerve impulse, starting from its occurrence at the rest state, then **mention** the direction of the nerve impulse transmission. **Explain your answer.**



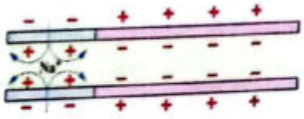

(1)




(2)



(3)



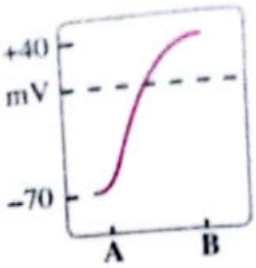

(4)

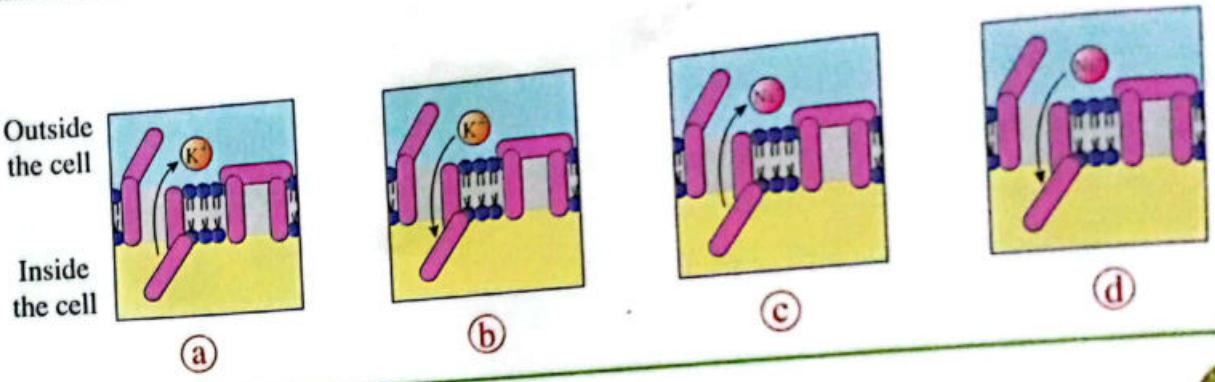
10 The nervous tissue is supported by nervous components and other non-nervous components. **Prove this with an example for the two components.**

# Test 2

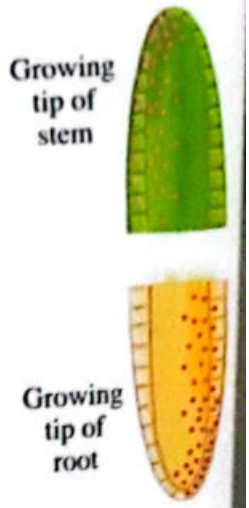
**Choose the correct answer (1 : 8) :**

**1** Which of the following figures represents the flow of a larger amount of ions during the period (A : B) of the nerve impulse transmission in the opposite graph ?




**2** The opposite figure illustrates the accumulation of auxins in a side of the growing tip for each of the stem and root in a vertical position, what is the expected result in both states ?

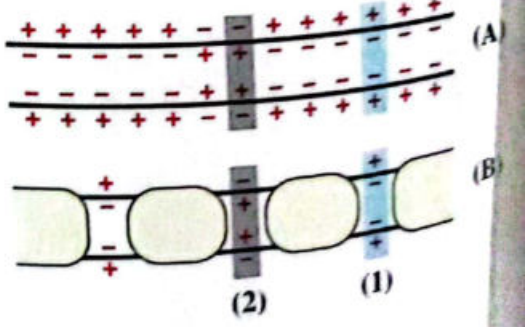



(a) Activating the elongation of the two sides cells where the auxins accumulate.
(b) Inhibiting the elongation of the two sides cells where the auxins accumulate.
(c) Both tips bend in the same direction.
(d) Both tips bend in two opposite directions.

**3** Which of the following organelles characterize(s) the nerve cell from the glial cells ?

(a) Centrosome.
(b) Nucleus.
(c) Mitochondria.
(d) Nissl's granules.

**4** The opposite figure illustrates two parts of two neuron's axons (A) and (B) having the same length, in which of the following does each of them differ from the other ?

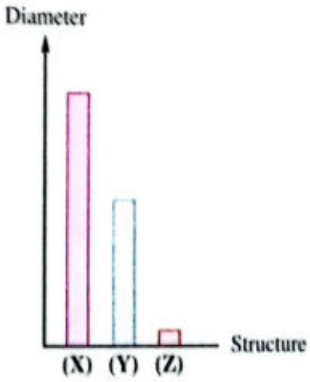



(a) The speed of the nerve impulse transmission.
(b) The passing direction of the nerve impulse.
(c) The potential difference at (1).
(d) The action potential at (2).

5 Which of the following is considered a reason for the non-response of a nerve fiber for one of the sensory nerve stimuli during the rest state ?

(a) The shortage of ATP molecules.
(b) The weakness of the stimulus strength.
(c) The absence of Ranvier's nodes.
(d) The absence of Nissl's granules.

6 In the opposite graph, structure (X) consists of groups of structure (Y) that consists of groups of structure (Z) which is surrounded by a neurolemma membrane. What does structure (Y) represent ?

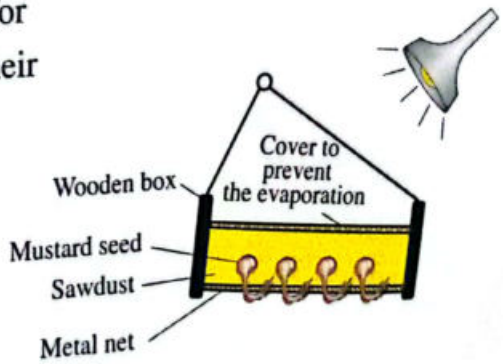



(a) A myelinated axon of nerve cell.
(b) A non-myelinated axon of nerve cell.
(c) Nerve bundle.
(d) Nerve.

7 In which of the following the motor nerve cells and the sensory nerve cells participate in the right arm ?

(a) The direction of the nerve impulse with respect to the arm.
(b) The connection with the responding organ.
(c) The connection with the receptor organ.
(d) The connection with the central nervous system.

8 In the opposite figure, what is your explanation for taking the roots the illustrated direction during their growth after several days of the irrigation ?




(a) The root is positive geotropic.
(b) The root is positive hydrotropic.
(c) The root is negative phototropic.
(d) The tropism has no role in this state.

Answer the following questions (9 & 10) :

**9** **Study the opposite figures, then determine** the scientific mistake that is found in the figure. **Explain your answer.**

(1) (2)

**10** The role of mitochondria that are present in the nerve cell body increases in one of the nerve impulse stages, **determine** this stage and the role of mitochondria in it.

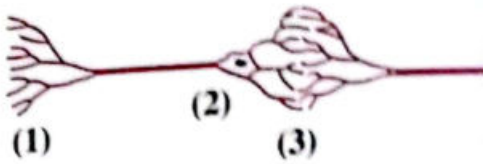
# 10 General Exams

- El-Moasser Exams (Exam 1 : Exam 5).
- Final Exams of some Educational Administrations (Exam 6 : Exam 10).

You can reach the exams of some schools and educational administrations by scanning the opposite QR code.

## Choose the correct answer (1 : 20) :

**1** The opposite figure represents the connection between two nerve cells, where the two parts (1) and (2) are found in the grey matter of the spinal cord.




What is the direction of the nerve impulse ?

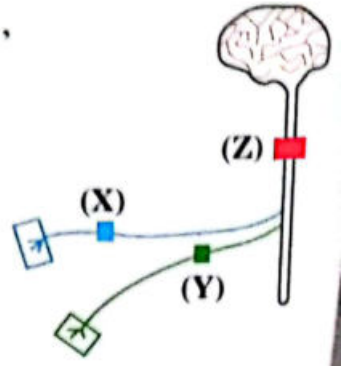
ⓐ (1) ⟶ (2) ⟶ (3) ⟶ Motor nerve cell.

ⓑ (3) ⟶ (2) ⟶ (1) ⟶ Motor nerve cell.

ⓒ (1) ⟶ (2) ⟶ (3) ⟶ Sensory nerve cell.

ⓓ Sensory nerve cell ⟶ (1) ⟶ (2) ⟶ (3).

**2** ❋ The opposite figure illustrates three regions in the nervous system, where (X) represents a sensory nerve, (Y) represents a motor nerve and (Z) represents the spinal cord. What is the position that if it is exposed to damage, it will lead to feeling no pain with the ability to move the foot ?




ⓐ (X) or (Z).

ⓑ (Y) or (Z).

ⓒ (Y) only.

ⓓ (X) only.

**3** Which choice in the following table leads to decreasing the water amount in urine ?

| | The activity performed by the body | The surrounding temperature |
|---|---|---|
| ⓐ | Low | Low |
| ⓑ | High | Low |
| ⓒ | Low | High |
| ⓓ | High | High |

**4** ❋ Which of the following parts will have a different response due to the accumulation of auxins in them ?

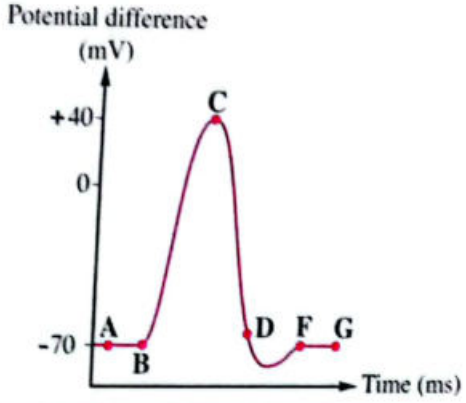
ⓐ The side of stem that is away from light.

ⓑ The lower side of root in the horizontal position.

ⓒ The side of root that is away from light.

ⓓ The side of root that is facing water.

5 * The opposite graph illustrates the stages passed by a neuron that is exposed to a stimulus. In which of the following stages do you expect that another new nerve impulse is generated through it, if another stimulus with a higher strength than the first stimulus affects it ?

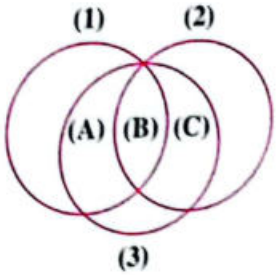



(a) From (A) to (B). (b) From (B) to (C).
(c) From (C) to (D). (d) From (F) to (G).

6 Which of the following represent(s) the location of the bodies of nerve cells that transmit the incoming information to the spinal cord ?

(a) Ventral roots. (b) Dorsal roots. (c) Grey matter. (d) White matter.

7 * In the opposite figure, organs no. (1), (2) and (3) represent skin, lungs and kidneys respectively, what do the excretory substances (A), (B) and (C) represent respectively ?




(a) Spices / Nitrogenous wastes / Water.
(b) Nitrogenous wastes / Spices / Water.
(c) Nitrogenous wastes / Water / Spices.
(d) Spices / Water / Nitrogenous wastes.

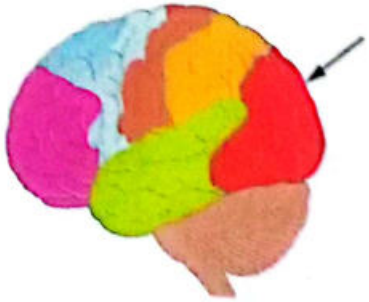
8 Which of the following statements **isn't** applied to indole-acetic acid in the plant ?

(a) It moves away from light. (b) It flows from up to down.
(c) It affects the growth of cells. (d) It passes through gelatine and mica.

9 Which of the following **aren't** related to each other ?

(a) Aquiring the skin hair with elasticity and the activity of autonomic nervous system.
(b) The skin epidermal layer and the increase in body weight.
(c) The blood capillaries in the skin and the rate of sweat secretion.
(d) The body wastes and the blocking of skin pores.

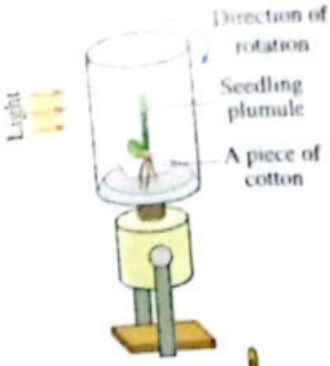
10 If a damage is occurred to the part that is referred to in the opposite figure, due to the occurrence of an accident. What is the result of it ?

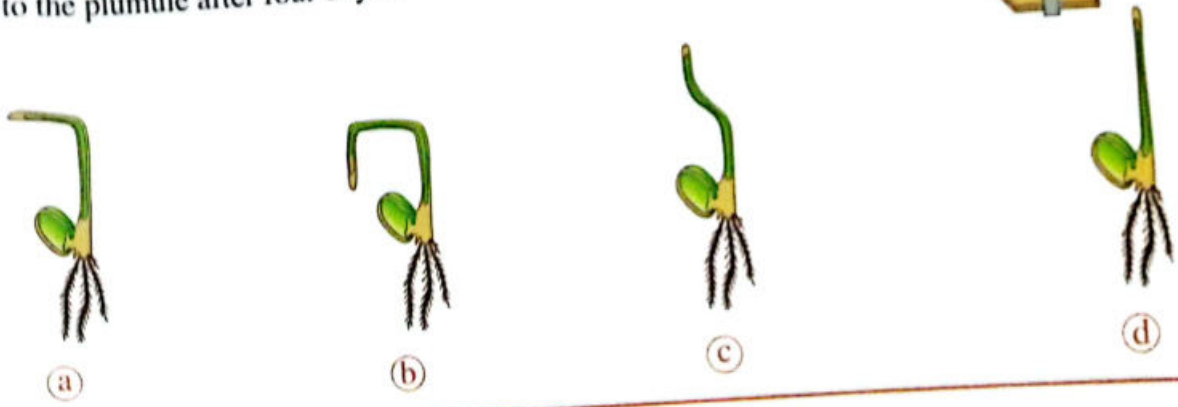


(a) A change in the body temperature.
(b) Rapid breathing.
(c) A disturbance in the body balance.
(d) Losing the sight sense.

EXAM 1

**11** * The opposite figure represents a plant seedling that is fixed on a surface rotating horizontally and exposed to light from one side only, the seedling was rotated for four days, which of the following figures illustrates what will happen to the plumule after four days ?




**12** * Which of the following whose absence affects the return of nerve fiber membrane to the rest state ?

(a) Myelin sheath.
(b) Mitochondria.
(c) Terminal arborizations.
(d) Dendrites.

**13** In the opposite figure, which of the following statements is applied to the two structures (1) and (2) ?


(a) Some molecules are filtered from (1) to (2).
(b) Some molecules are filtered from (2) to (1).
(c) Some molecules are reabsorbed from (2) to (1).
(d) Some molecules are reabsorbed from (1) to (2).

**14** Which of the following statements is correct ?

(a) The transpiration process results in permanent precipitation of some substances.
(b) The hydathodes are found at the tips of leaves.
(c) The stomata are found in the leaf only.
(d) The components of guttation water are similar to the components of transpiration water.

**15** Which of the following expresses the concentration of ions outside the nerve cell membrane at rest ?

(a) High for each of sodium and potassium.
(b) Low for each of sodium and potassium.
(c) High for sodium and low for potassium.
(d) Low for sodium and high for potassium.

6 * If you know that the haemoglobin is from the small-sized protein molecules which are found in the red blood corpuscles, which of the following parts is expected to have haemoglobin ?

(a) The glomerulus.
(b) Bowman's capsule.
(c) The nephric tubule.
(d) The sweat duct.

17 When exposing a plant to a hot sunny day, which of the following is expected to happen ?

(a) The rate of water absorption and transpiration will increase.
(b) The rate of water absorption and transpiration will decrease.
(c) The rate of water absorption will increase and the rate of transpiration will decrease.
(d) The rate of water absorption will decrease and the rate of transpiration will increase.

18 Which of the following are connected together by Pons Varolii ?

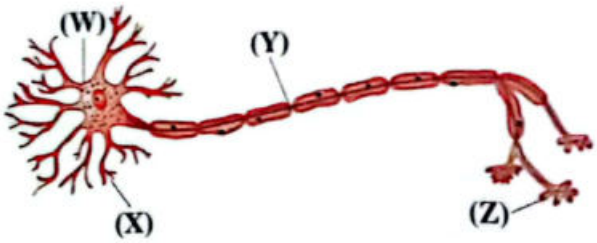
(a) Brain and spinal cord.
(b) Brain and cerebellum.
(c) Two cerebral hemispheres.
(d) Medulla oblongata and spinal cord.

19 Which of the following statements is correct in the normal cases ?

(a) The number of collecting ducts is always greater than that of the nephrons.
(b) The number of nephrons is always greater than that of the collecting ducts.
(c) The number of nephrons is nearly equal to the number of collecting ducts.
(d) The more increase in the number of collecting ducts, the more decrease in the number of nephrons.

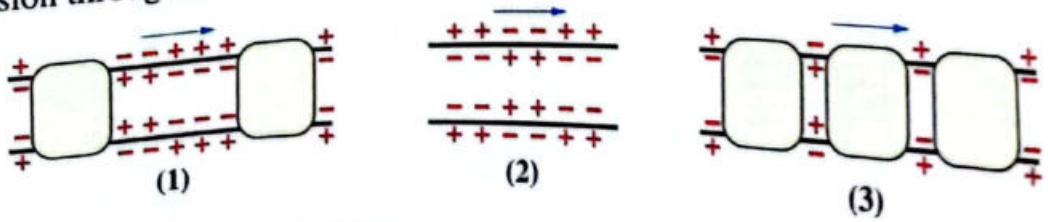
20 * In the opposite figure, through which of the following parts the nerve impulse is transmitted to this nerve cell ?

(a) (W) or (X).
(b) (X) or (Z).
(c) (W) or (Z).
(d) (Y) or (Z).




## Answer the following questions (21 : 23) :

21 **Arrange** the following parts of nerve axons, according to the speed of the nerve impulse transmission through them from the slowest to the fastest :



EXAM 1

22 **Explain** : the ways of plant excretion through the vegetative system are variable.

..... / 1 mark

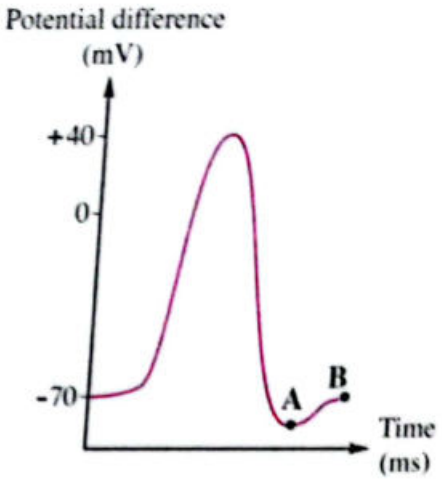
23 If you know that some insecticides contain an inhibitor for the cholinesterase enzyme. **Show what will happen to the nervous function when a human is exposed to an amount of these insecticides.**

..... / 2 marks

The questions signed by (*) are answered in detail.

## Choose the correct answer (1 : 20) :

1 * The opposite graph shows the stages passed by a nerve cell which was exposed to stimulation, which of the following ions whose flow by large amounts leads to the arrival of the curve to point (A) before reaching point (B) ?




(a) Sodium to inside the cell.
(b) Potassium to inside the cell.
(c) Sodium to outside the cell.
(d) Potassium to outside the cell.

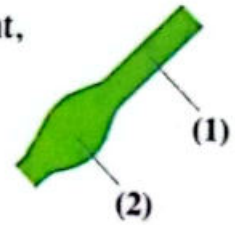
2 * Which of the following is(are) reabsorbed by active transport ?

(a) Red blood corpuscles.
(b) Large protein molecules.
(c) Glucose.
(d) Urea.

3 Which of the following brain regions is the most related to the involuntary control of respiration ?

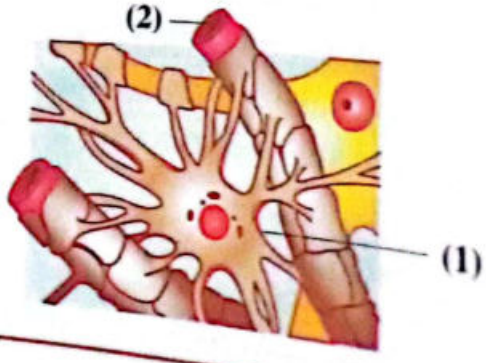
(a) Thalamus.
(b) Temporal lobe.
(c) Medulla oblongata.
(d) Pons Varolii.

4 The opposite figure illustrates a part of the primary rachis of *Mimosa* plant, what happens when touched ?




(a) Part no. (1) bends downward, so that part no. (2) shrinks.
(b) Part no. (2) shrinks, so that part no. (1) bends downward.
(c) Part no. (2) shrinks, so that the water diffusion to it from part no. (1) increases.
(d) The diffusion of water out of part no. (1) increases, so that part no. (2) shrinks.

5 The opposite figure shows the connection of structure no. (2) with cell no. (1), which of the following represents cell no. (1) ?

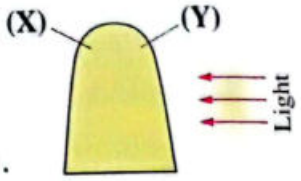



(a) Connector neuron.
(b) Neuron that lost its axon.
(c) Nutritive cell.
(d) Cell that is unable to divide.

6 Which of the following **aren't** affected by each other ?

(a) Melanin and keratin.
(b) The surface and inner layers of the skin epidermis.
(c) Hair and fat glands.
(d) Parietal lobe and sensory nerve endings.

7 In the opposite figure, which of the following statements is applied to the seedling, after its exposure to light for a period of time from one side ?




(a) The cells of part (Y) are more elongated than the cells of part (X).
(b) The concentration of auxins in part (Y) is higher than that in part (X).
(c) The seedling bends in the opposite direction of auxins accumulation.
(d) The cells of the two parts (X) or (Y) are not affected.

8 What is the first region in the urinary system in which the liquid passes through it is called "urine" ?

(a) Bowman's capsule.
(b) Loop of Henle.
(c) Collecting duct.
(d) Urinary bladder.

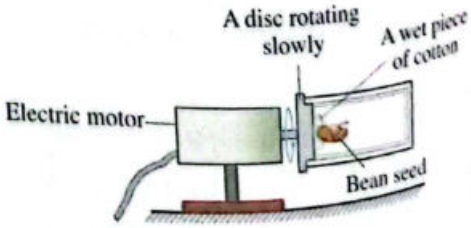
9 * Which of the following **doesn't** agree with the opposite diagram of the nerve fiber membrane ?


(a) The membrane is at the depolarization state.
(b) The concentration of sodium ions inside is higher than outside.
(c) The potential difference on the two sides of the membrane equals 110 mV.
(d) The nerve cell will need ATP

10 * Which of the following systems whose action activated, when the urinary bladder is full ?

(a) The sympathetic nervous system.
(b) The parasympathetic nervous system.
(c) The central nervous system.
(d) The two types of autonomic nervous system.

11 * The opposite figure illustrates a growing seed of bean plant in a horizontal position, where it was placed on a disc rotating vertically in slow manner for 3 days, then left fixed for another two days, which of the following figures illustrates the shape of the radicle after five days ?





(a)


(b)


(c)


(d)

12 Which of the following represents the role of cholinesterase enzyme ?
(a) Starting the nerve impulse.
(b) Stopping the nerve impulse.
(c) Increasing the speed of nerve impulse.
(d) Decreasing the speed of nerve impulse.

13 * Where is the highest percentage of urea found ?
(a) In the hepatic vein.
(b) In the hepatic portal vein.
(c) In the efferent blood capillaries of nephron.
(d) In the renal vein.

14 Which of the following statements describes the action potential ?
(a) The flow of sodium ions outside the nerve fiber membrane.
(b) The flow of sodium ions inside the nerve fiber membrane.
(c) The flow of potassium ions inside the nerve fiber membrane.
(d) The flow of calcium ions inside the nerve fiber membrane.

15 Where are the signals transfer in case of the hand pulling when exposed to a flame ?
(a) To the brain directly.
(b) To the spinal cord, then to the muscle.
(c) Through the sensory cells only.
(d) Through the motor cells only.

16 Which of the following is(are) abundant inside the nerve cell during the rest state ?
(a) Neuroplasm.
(b) Mitochondria.
(c) Nissl's granules.
(d) Golgi bodies.

17 Which of the following **isn't** correct about the nerve impulse ?
(a) It moves in one direction through the nerve fiber.
(b) It moves in two directions in some nerves.
(c) It moves in two directions through the synapse.
(d) Its speed differs according to the nerve type.

18 * Which of the following systems whose action is expressed by the two words "rest and digest" ?
(a) Central nervous system.
(b) The two types of autonomic nervous system.
(c) Parasympathetic nervous system.
(d) Sympathetic nervous system.

19 * The following table illustrates four urine samples and the lost amount of sweat for a person in different weather days, which sample in the following table was collected in a cold day ?

| | Urine volume ($cm^3$) | Sweat volume ($cm^3$) |
|---|---|---|
| (a) | 1.5 | 0.8 |
| (b) | 0.8 | 0.8 |
| (c) | 0.8 | 1.5 |
| (d) | 1.2 | 1.1 |

20 On increasing the temperature of the body, the following occurs :

(1) The dilation of blood capillaries.

(2) The activation of sweat glands.

(3) The stimulation from the hypothalamus region of brain.

(4) The action of sympathetic nerve fibers.

What is the arrangement of these stages occurrence ?

(a) (2), (3), (1) and (4).

(b) (3), (4), (1) and (2).

(c) (3), (1), (4) and (2).

(d) (3), (2), (1) and (4).

## Answer the following questions (21 : 23) :

21 **Explain :** the phototropism of a plant stem isn't affected by the shortage of ATP

1 mark

22 **Study the following table that shows the environmental factors surrounding four plants from the same type :**

| Plant | Environmental factors |
|---|---|
| First | Dry air & temperature (15°C) |
| Second | Dry air & temperature (25°C) |
| Third | Dry air & temperature (30°C) |
| Fourth | Moist air & temperature (30°C) |

**Determine** which of the previous plants will absorb the greatest amount of water.

**Explain your answer.**

2 marks

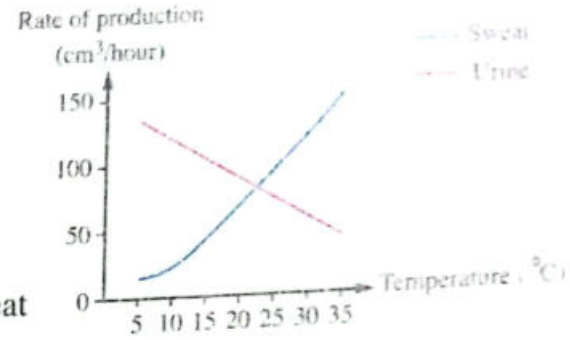
23 **Mention** three functions that depend on the action of both the midbrain and forebrain.

1 mark

The questions signed by ✱ are answered in detail.

## Choose the correct answer (1 : 20) :

**1** ✱ The opposite graph illustrates the rate of production of each of sweat and urine in human at different temperatures, which of the following statements is applied to this graph ?




(a) The more increase in temperature, the more decrease in the sweat production rate.

(b) The rate of production of each of urine and sweat is equal at the temperature 22°C.

(c) The rate of each of urine and sweat production is directly proportional to the temperature.

(d) There is no relation between the rate of production of urine and that of sweat.

**2** In which of the following the renal filtrate in human is similar to the transpiration water in plant ?

(a) The presence of mineral salts.

(b) Decreasing the temperature of living organism.

(c) Passing through the plasma membranes of cells.

(d) The excretion increases with the increase of the surrounding temperature.

**3** ✱ The change of potential difference on the two sides of the nerve fiber membrane from –70 mV to +40 mV to –80 mV, then –70 mV. What do these values represent respectively ?

(a) Polarization / Increasing polarization / Repolarization / Depolarization.

(b) Polarization / Depolarization / Increasing polarization / Repolarization.

(c) Depolarization / Repolarization / Polarization / Increasing polarization.

(d) Depolarization / Increasing polarization / Repolarization / Polarization.

**4** Which choice in the following table shows the substances that are expected to be found in some parts of the urinary system in a healthy person ?

| | Renal artery | Renal vein | Ureter | Urinary bladder |
|---|---|---|---|---|
| (a) | Glucose | Protein | Salts | Urea |
| (b) | Protein | Salts | Water | Protein |
| (c) | Salts | Water | Protein | Water |
| (d) | Urea | Glucose | Glucose | Salts |

5 From which of the following regions the nerve fibers that act on relaxing the urinary bladder arise ?

(a) Thoracic region of spinal cord.
(b) Lumbar region of spinal cord.
(c) Brain stem region.
(d) Sacral region of spinal cord.

6 Which of the following choices shows the change in the rate of transpiration during daytime, on increasing the temperature and decreasing the humidity in the atmosphere respectively ?

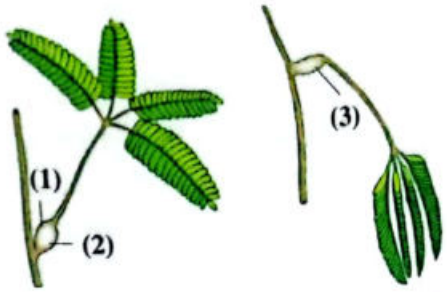
(a) Decreases / Decreases.
(b) Increases / Increases.
(c) Increases / Decreases.
(d) Decreases / Increases.

7 * In which of the following cases the growth of plant cells in the vertical position is equivalent ?

(a) The positive phototropism of stem.
(b) The negative phototropism of root.
(c) The negative geotropism of stem.
(d) The positive hydrotropism of root.

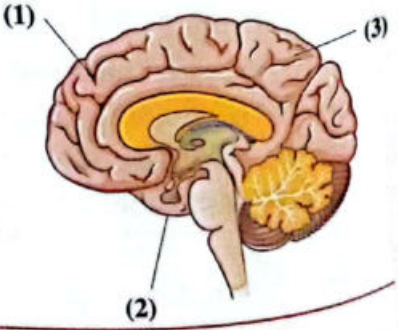
8 The two opposite figures illustrate two states for a part from *Mimosa* plant, which of the following parts their cells are characterized by their sensitivity more than the other ?

(a) (1) more than (2).
(b) (1) more than (3).
(c) (2) more than (1).
(d) (2) more than (3).



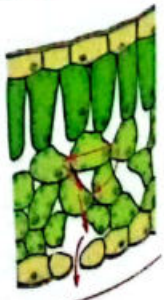

9 * In the opposite figure, what do lobes no. (1), (2) and (3) represent respectively ?

(a) Frontal / Parietal / Temporal.
(b) Frontal / Temporal / Parietal.
(c) Frontal / Parietal / Occipital.
(d) Frontal / Temporal / Occipital.




10 What is the percentage of water lost from the process that is illustrated by arrows in the opposite figure, according to the total amount of water lost by the plant ?

(a) 5%
(b) 10%
(c) 15%
(d) 90%



11 Which of the following doesn't(don't) act on nourishing the nerve cells in the brain ?

(a) Neuroglia. (b) Nissl's granules.
(c) Pia mater. (d) The myelin sheath.

12 Which of the following their presence indicates that the skin is a protective, sensory and excretory organ respectively ?

(a) Keratin, sensory nerve endings and sweat glands.
(b) Melanin, blood vessels and fat glands.
(c) Melanin, sensory nerve endings and fat glands.
(d) Fat glands, blood vessels and sweat glands.

13 What is the ion that is responsible for the transmission of the nerve impulse from the terminal arborizations to the muscle fiber ?

(a) Potassium. (b) Calcium. (c) Sodium. (d) Chloride.

14 * When you move from an illuminated room to a dark room, changes occurred in the eye, enabling you to see clearly, which of the following is responsible for these changes ?

(a) The occurrence of reflex arc through which the eye pupil is constricted by the effect of parasympathetic nervous system.
(b) The occurrence of reflex arc through which the eye pupil is dilated by the effect of sympathetic nervous system.
(c) The complete control of the vision centres that are found in the occipital lobe.
(d) The centres connected with the vision that are found in the midbrain.

15 Through which of the following the highest rate of water excretion from the plant takes place ?

(a) Leaves. (b) Herbaceous stem. (c) Woody stem. (d) Roots.

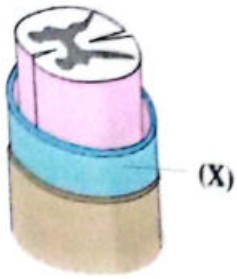
16 Which of the following **isn't** correct about Schwann cells ?

(a) They are found around the neuron body.
(b) They represent a special type of glial cells.
(c) They have a role in the speed of nerve impulse transmission.
(d) They produce lipid substance.

17 When the body temperature increases on the infection with a fever, what is the effect of that on the skin blood vessels and the rate of sweat secretion respectively ?

(a) Dilate / Stops relatively. (b) Dilate / Increases.
(c) Constrict / Stops. (d) Constrict / Increases.

18 * The opposite figure illustrates a section in a part of the nervous system, what does structure (X) represent ?




(a) The sheath of nerve bundle.
(b) The sheath of nerve.
(c) One of the meninges.
(d) A myelin sheath.

19 If you know that the vertebrae of the vertebral column are arranged from up to down into five regions as follows : 7 / 12 / 5 / 5 / 4. In which of the following regions the pairs number of the spinal nerves is equal to the number of vertebrae that are located in these regions ?

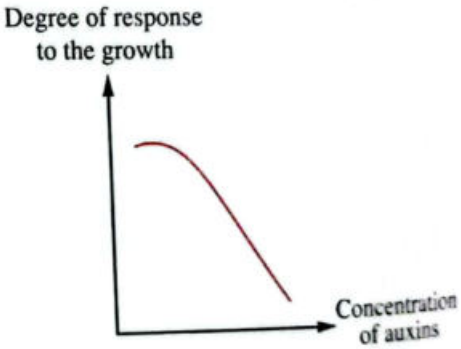
(a) Cervical, thoracic and lumbar.
(b) Thoracic, lumbar and sacral.
(c) Lumbar, sacral and coccygeal.
(d) Cervical, sacral and coccygeal.

20 * What is the most affected state by the shortage of ATP molecules in the nerve cell ?

(a) Polarization.
(b) Depolarization.
(c) Increasing polarization.
(d) Refractory period.

## Answer the following questions (21 : 23) :

21 From the opposite graph that illustrates the relationship between the response of a plant tissue to the growth in different concentrations of auxins. **Is this tissue a stem or a root ?**
**Explain your answer.**




2 marks

22 **Explain :** the ability of the nerve impulse to propagate in one direction between the presynaptic and postsynaptic membranes.

1 mark

23 **What happens in case of :** stopping the selective reabsorption process in the kidney nephrons with the continuity of filtration process ?

1 mark

# General Exam 4

The questions signed by (*) are answered in detail.

## Choose the correct answer (1 : 20) :

**1** The following table illustrates the amount of water and salts lost from the body through the two kidneys and skin in a hot day and another cold day :

| Day | The amount of water lost ($cm^3$) from | | The amount of salts lost (g) from | |
|---|---|---|---|---|
| | Two kidneys | Skin | Two kidneys | Skin |
| Hot | 0.4 | 2.3 | 14.4 | 5.8 |
| Cold | 1.8 | 0.1 | 20.2 | 0.1 |

From the previous table, which of the following can be concluded ?

(a) The amount of water lost from the two kidneys in the cold day is lower than that lost in the hot day.

(b) The kidneys lose a lot of salts in the hot day, comparing with the salts lost in the cold day.

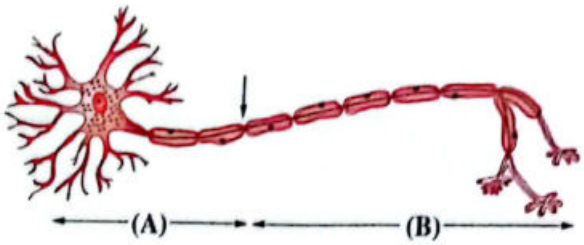
(c) The amount of salts lost from the body is nearly equal in both days.

(d) The two kidneys don't excrete any amount of water in the hot day.

**2** * Which of the following **aren't** from the structures of excretion in the bean plant ?

(a) Epidermis of leaves. (b) Stomata of leaves. (c) Lenticels. (d) Hydathodes.

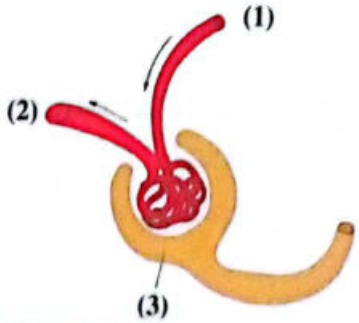
**3** * If a cut is occurred to the axon of a neuron at the position of the shown arrow, part (B) will be compensated, which of the following has(have) a role in this ?




(a) Neuroplasm. (b) Neuroglia.

(c) Dendrites. (d) Nissl's granules.

**4** * In the opposite figure, which of the following statements is applied to the red blood corpuscles ?




(a) Their percentage in no. (1) is higher than that in no. (2).

(b) Their percentage in no. (2) is higher than that in no. (1).

(c) Their percentage is equal in both no. (1) and (2).

(d) Their percentage in no. (3) is equal to no. (1) or (2).

**5** Which of the following is applied to the auxins in each of the phototropism of stem in a vertical position and the geotropism of stem in a horizontal position ?

(a) They act in the same direction of the stimulus.

(b) They get away from the stimulus.

(c) They inhibit the growth of cells.

(d) They stimulate the growth of cells.

6 Which of the following **isn't** from the functions of skin dermis ?

ⓐ The decrease of body temperature. ⓑ The moisturizing of skin epidermis.

ⓒ The response to the external stimuli. ⓓ Acquiring the skin its colour.

7 Which of the following **doesn't** represent a link between two organs or two structures in the nervous system ?

ⓐ Connector neuron. ⓑ Pons Varolii. ⓒ Midbrain. ⓓ The 5th lobe.

8 Which of the following represents the first part of the sensory path ?

ⓐ Gland. ⓑ Skin. ⓒ Muscle. ⓓ Responding organ.

9 Which choice in the following table leads to the least rate of transpiration process in the plant ?

| | Humidity (%) | Amount of light | Temperature (°C) |
|---|---|---|---|
| ⓐ | 10 | High | 4 |
| ⓑ | 10 | Low | 14 |
| ⓒ | 80 | High | 14 |
| ⓓ | 80 | Low | 4 |

10 ✱ The opposite figure represents a neuron, which of the following choices describes the type of this cell and the direction of the nerve impulse respectively ?

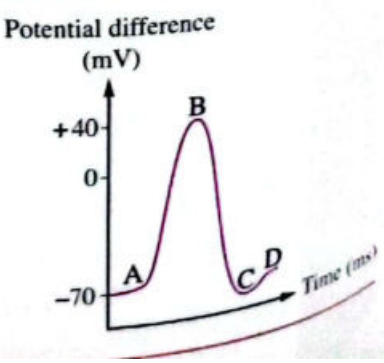

ⓐ Motor / (1) ⟶ (2). ⓑ Motor / (2) ⟶ (1).

ⓒ Sensory / (1) ⟶ (2). ⓓ Sensory / (2) ⟶ (1).

11 Which of the following its/their action is similar in animal with the action of stomata in plant ?

ⓐ Kidney. ⓑ Nephron. ⓒ Sweat gland. ⓓ Sweat pores.

12 ✱ The opposite graph illustrates the stages passed by a neuron that is exposed to stimulation, which of the following points represents an increase in the polarization ?




ⓐ A ⓑ B

ⓒ C ⓓ D

13 * Which of the following cells have the ability to divide ?

(a) The surface layer cells of skin epidermis. (b) The inner layer cells of skin epidermis.

(c) The nerve cells. (d) The red blood cells.

14 Which of the following **isn't** considered from the functions of transpiration process in the plant ?

(a) It increases the rate of mineral salts absorption from the soil.

(b) It allows the entry of $CO_2$ into the plant that is required for the photosynthesis process.

(c) It decreases the plant temperature.

(d) It rises more water from the soil to the leaves.

15 The action of five senses of human are controlled by the nervous centres that are located in the brain lobes, what are those lobes ?

(a) Frontal, parietal and occipital. (b) The $5^{th}$ lobe, frontal and parietal.

(c) Occipital, temporal and parietal. (d) Frontal, parietal and temporal.

16 Which of the following statements **isn't** correct about the synapse ?

(a) The neurotransmitters affect the postsynaptic membrane.

(b) The synaptic cleft separates between the cells of the synapse.

(c) It may include more than one neuron.

(d) The neurotransmitters are secreted from the dendrites.

17 Which of the following parts **doesn't(don't)** have glucose in a healthy person ?

(a) Renal artery. (b) Bowman's capsule.

(c) Collecting ducts in the kidneys. (d) Glomerulus.

18 What happens when binding a poisonous substance with the receptors that are found on the surface of a muscle fiber ?

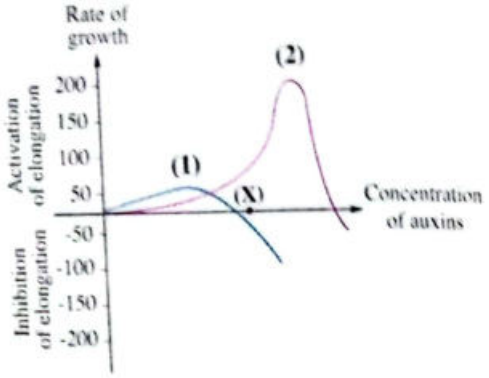
(a) The increase in releasing the neurotransmitters.

(b) The occurrence of depolarization state.

(c) The muscle contraction.

(d) Preventing the occurrence of depolarization state.

19 * In the opposite graph, at the concentration of auxins (X), which of the following expressed by the two curves (1) and (2) respectively ?




(a) Positive phototropism for the stem / Negative phototropism for the root.

(b) Negative phototropism for the root / Positive phototropism for the stem.

(c) Positive phototropism for the stem / Negative geotropism for the stem.

(d) Positive geotropism for the root / Negative phototropism for the root.

20 Which of the following represents a role of autonomic nerve fibers that arise from the brain stem region ?

(a) The contraction of urinary bladder.

(b) The decrease in the secretion of adrenaline hormone.

(c) The dilation of bronchioles.

(d) The increase in the secretion of salivary glands.

## Answer the following questions (21 : 23) :

21 A person whose body contains 6 liters of blood, his two kidneys filter 1.2 liters of blood in one minute. **How many times does the total volume of blood pass through his kidneys in one hour ?**

2 marks

22 The distribution of auxins in the plant parts depend on some external factors. **Prove by an example.**

1 mark

23 **What happens in case of :** the non-occurrence of refractory period after transmitting the nerve impulse ?

1 mark

The questions signed by (*) are answered in detail.

## Choose the correct answer (1 : 20) :

1 The dog gasps when its body temperature increases or exerting an effort, why does the dog do this ?

(a) Because the kidneys are more compact.
(b) Because the urinary bladder is absent from the urinary system.
(c) Because the decrease in the secretion of sweat is compensated.
(d) Because the number of fat glands decreases.

2 Which of the following statements **isn't** correct ?

(a) The nerve impulse passes through the synapse in the form of electrical impulses.
(b) The neurotransmitters are found inside the synaptic vesicles.
(c) The nerve impulse passes through the neuron axon always in one direction.
(d) The nerve impulse obeys all or none law.

3 The opposite figure illustrates a seedling of bean plant that was grown in dark, what is the scientific term for the response of the stem ?

(a) Positive geotropism.
(b) Negative phototropism.
(c) Positive phototropism.
(d) Negative geotropism.

4 Which of the following is from the plant adaptive means with the decrease of water in the soil ?

(a) Decreasing the rate of transpiration.
(b) The hydrotropism.
(c) Increasing the rate of photosynthesis.
(d) Increasing the guttation process.

5 Which choice in the following table represents the amount of water lost from the body in a very hot day ?

| | The decrease of water amount that lost from | The increase of water amount that lost from |
|---|---|---|
| (a) | Skin | Kidneys |
| (b) | Kidneys | Lungs |
| (c) | Kidneys | Skin |
| (d) | Skin | Lungs |

6 From which of the following regions the nerve fibers that act on the contraction of the urinary bladder arise ?

(a) The thoracic region of spinal cord.
(b) The lumbar region of spinal cord.
(c) The brain stem region.
(d) The sacral region of spinal cord.

EXAM 5

7 Which of the following is applied to the phototropism of each of stem and root ?
(a) The auxins work in the same direction of the stimulus.
(b) The auxins get away from the stimulus.
(c) The auxins inhibit the growth of cells. (d) The auxins stimulate the growth of cells.

8 Which of the following represents the role of myelin substance ?
(a) Decreasing the transmission rate of nerve impulse.
(b) Covering the axon of the nerve cell completely.
(c) The appearance of the outer layer of the spinal cord with white colour.
(d) The appearance of the inner layer of the spinal cord with grey colour.

9 Which of the following **doesn't** occur on the blocking of sweat pores ?
(a) The increase of body temperature. (b) The emission of unpleasant odour.
(c) The brittle of skin hair. (d) The increase of urine secretion rate.

10 Which of the following choices represents the concentration of sodium and potassium ions outside the neuron membrane during the depolarization state respectively ?
(a) High / High. (b) Low / Low. (c) High / Low. (d) Low / High.

11 When an infection occurs that affects the reabsorption process of salt ions from the renal filtrate, where are the infected cells located ?
(a) Bowman's capsule. (b) Collecting duct.
(c) Nephric tubules. (d) Kidney pelvis.

12 Which of the following statements agrees with the water excretion in the plant ?
(a) The hydathode controls the time of excretion of guttation water.
(b) The hydathode is opened in the early morning and closed at night.
(c) The physical form of the excreted water in transpiration differs from that in the hydathode.
(d) The transpiration process depends on the connection with the terminals of veins in the leaf.

13 Which of the following statements agrees with the motor neurons ?
(a) They are not connected with the central nervous system.
(b) Their bodies are outside the grey matter.
(c) They are not connected with the terminal arborizations of the connector neurons.
(d) They don't pass inside the dorsal roots of the spinal cord.

14 Which of the following characterizes the purifying liquid in the artificial kidney device ?
ⓐ It contains a higher level of glucose than that in blood.
ⓑ It contains a lower level of glucose than that in blood.
ⓒ It contains an equal level of glucose to that in blood.
ⓓ It doesn't contain glucose.

15 * Which of the following nervous systems whose action can be expressed by the two words "fight or flight" ?
ⓐ Parasympathetic.
ⓑ Sympathetic.
ⓒ The two types of autonomic.
ⓓ Central.

16 Which of the following nervous system parts receives the nerve impulse from the optic nerve ?
ⓐ The cerebellum.
ⓑ The posterior part of the two cerebral hemispheres.
ⓒ The spinal cord.
ⓓ Hypothalamus.

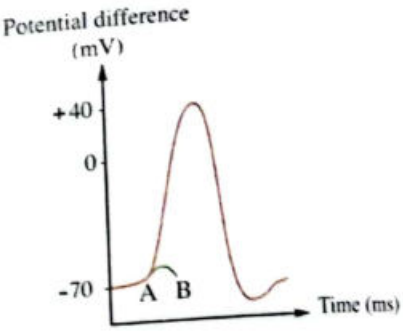
17 Which of the following **aren't** related to each other ?
ⓐ The surface layer and inner layer of the skin epidermis.
ⓑ The nerve cells and neuroglia.
ⓒ The rate of excretion and the rate of catabolism.
ⓓ The hydrotropism and the auxins concentration in the stem.

18 Which of the following leads to the resting potential of a neuron ?
ⓐ The equal distribution of ions inside and outside the cell.
ⓑ The membrane selective permeability to ions.
ⓒ The outflow of chloride ions.
ⓓ The increase in sodium ions permeability to inside.

19 What is the result of increasing the atmospheric temperature at the end of spring season ?
ⓐ Increasing the rate of each of transpiration and guttation.
ⓑ Decreasing the rate of each of transpiration and guttation.
ⓒ Increasing the rate of transpiration and decreasing the rate of guttation.
ⓓ Decreasing the rate of transpiration and increasing the rate of guttation.

EXAM 5

20 * In the opposite graph, the curve illustrates the stages that passed by a nerve cell which exposed to stimulation, what do you deduce from curve (AB) ?




(a) The nerve impulse is transmitted without the occurrence of depolarization.

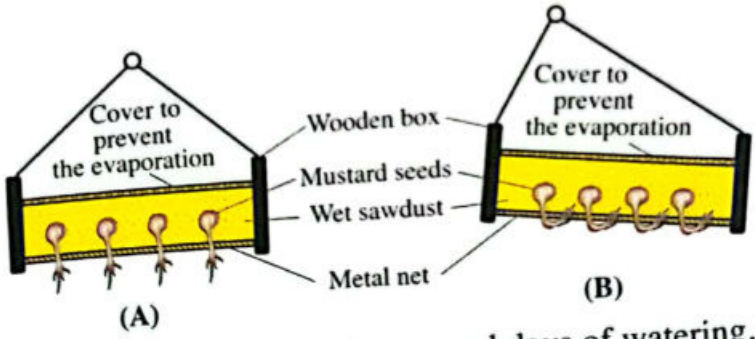
(b) The stimulus is very strong which leads to the occurrence of nerve impulse in a short time.

(c) The stimulus is weak which leads to the occurrence of a very short nerve impulse.

(d) The stimulus is weak and insufficient to stimulate the nerve fiber.

## Answer the following questions (21 : 23) :

21 **In the following figures, an experiment was carried out, where seeds were scattered in two identical boxes of wood, each with a base of metal net and has an equal amount of sawdust :**




**Explain** what happened in (A) and (B) after several days of watering.

2 marks

22 **What is the relation between :** calcium ions and the nerve impulse ?

1 mark

23 "The concentration of nitrogenous wastes and salts in sweat is higher than that in urine". **How far is this statement correct ? With explanation.**

1 mark

# Exam 6

## Choose the correct answer (1 : 20) :

1 The centre of vision is located in ..... lobe.
(a) frontal (b) parietal (c) occipital (d) temporal

2 Which of the following substances the plant **doesn't** excrete it through stomata of leaves ?
(a) Oxygen. (b) Carbon dioxide. (c) Pure water. (d) Mineral salts.

3 The ..... ions play an important role in transferring the nerve impulse from one nerve cell to another.
(a) sodium (b) potassium (c) calcium (d) chloride

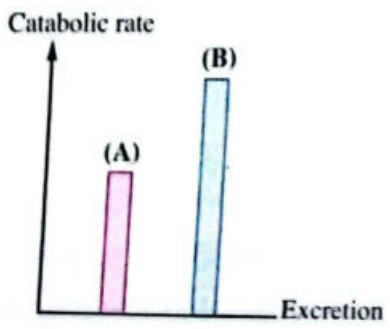
4 The blood vessel which carries blood from the kidney is .....
(a) renal artery. (b) ureter.
(c) renal vein. (d) inferior vena cava.

5 The reflex action starts in ..... and ends in .....
(a) organs – organs. (b) organs – brain.
(c) spinal cord – organs. (d) brain – spinal cord.

6 The amount of pumped blood by the heart and passes through the two kidneys in one minute is nearly ..... litres.
(a) 6 (b) 5 (c) 2.4 (d) 1.2

7 The unequal distribution of ions inside and outside the nerve cell leads to the .....
(a) action potential. (b) refractory period.
(c) resting potential difference. (d) depolarization state.

8 Study the opposite graph that represents two living organisms, then answer :
Catabolic rate of (A) and (B) represent ..... respectively, if they are equal in weight.
(a) plant and animal
(b) animal and animal with the same species
(c) animal and plant
(d) plant and plant with the same species



9 The largest number of spinal nerves are connected to ..... region.

(a) cervical (b) thoracic (c) lumbar (d) sacral

10 The centres of swallowing, vomiting, sneezing and cough are located in .....

(a) thalamus. (b) medulla oblongata. (c) hypothalamus. (d) cerebellum.

11 The highest concentration of salts in the nephron is in .....

(a) Bowman's capsule. (b) the first coiled tubule.
(c) loop of Henle. (d) collecting duct.

12 Some plants have tendrils that help them to twine around a support to grow normally. What is the factor that stimulates the grapes plant tendril to twine around the support ?

(a) Water. (b) Gravity. (c) Touch. (d) Light.

13 All the following are from the functions of neuroglia, except the .....

(a) support of the nerve cells. (b) transmission of nerve impulse.
(c) nutrition of nerve cells. (d) insulator among nerve cells.

14 The plant gets rid of excess calcium by accumulation in .....

(a) roots. (b) leaves. (c) stem. (d) fruits.

15 The centre of sensation of hotness and coldness is located in ..... lobe.

(a) frontal (b) parietal (c) temporal (d) occipital

16 The centres of hunger and satiety are located in ..... region.

(a) thalamus (b) hypothalamus
(c) the midbrain (d) the cerebral cortex

17 The uric acid is produced due to the breaking down of ..... substances.

(a) lipid (b) protein (c) carbohydrate (d) nucleic acid

18 The cholinesterase enzyme is located near to the .....

(a) dendrites membrane. (b) nodes of Ranvier.
(c) terminal arborization membrane. (d) nucleus of the nerve cell.

19 The nerve impulse is a/an ..... message.

(a) chemical (b) magnetic (c) electrochemical (d) electrical

20 The excess minerals and toxins cross the membrane of the artificial kidney machine by .....

(a) active transport. (b) diffusion.
(c) osmosis. (d) selective permeability.

## Answer the following questions (21 : 23) :

21 **What happens if :** the cerebellum is injured by a severe damage ?

..... 1 mark

22 **Give reason for :** the presence of Nissl's granules in the nerve cell body.

..... 1 mark

23 **Compare between :** the sweat gland and the nephron, **according to :** "the definition and site".

..... 2 marks

# Exam 7

## Giza Governorate
"Ausim Directorate"

### Choose the correct answer (1 : 20) :

1 Which of the following expresses the concentration of ions outside the nerve cell membrane at rest ?
(a) High for each of sodium and potassium.
(b) Low for each of sodium and potassium.
(c) High for sodium and low for potassium.
(d) Low for sodium and high for potassium.

2 Which of the following structures act as the sites for gas exchange in the woody stems ?
(a) Hydathodes. (b) Roots. (c) Stomata. (d) Lenticels.

3 Which of the following substances is(are) **not** found in the sweat ?
(a) Glucose. (b) Nitrogenous wastes. (c) Sodium salts. (d) Water.

4 Which of the following brain regions is most related to the involuntary control of respiration ?
(a) Temporal lobe. (b) Pons Varolii. (c) Medulla oblongata. (d) Thalamus.

5 Which of the following **doesn't(don't)** have a role in the excretion process ?
(a) Kidneys. (b) Lungs. (c) Skin. (d) Rectum.

6 Through which of the following the highest rate of water excretion from the plant takes place ?
(a) Herbaceous stem. (b) Leaves. (c) Woody stem. (d) Roots.

7 Which of the following represents the efferent neuron in the synapse between a neuron and a muscle fiber ?
(a) Mixed. (b) Connector. (c) Motor. (d) Sensory.

8 If a person is exposed to an injury in the frontal lobe, which of the following will be affected ?
(a) His memory.
(b) His body balance.
(c) His ability to see.
(d) The sensation with the external stimuli.

9 What is the ion that is responsible for the transmission of the nerve impulse from the terminal arborizations to the muscle fiber ?

ⓐ Chloride. ⓑ Sodium. ⓒ Calcium. ⓓ Potassium.

10 Which of the following cells **don't** have the ability to divide mitotically ?

ⓐ Neuroglia.
ⓑ Nerve cells.
ⓒ The cells of the inner layer of skin epidermis.
ⓓ The cells of the growing tip of an oat seedling.

11 Which of the following substances is(are) excreted from the body by one organ only and no organ participates with it ?

ⓐ Carbon dioxide. ⓑ Urea.
ⓒ Water and mineral salts. ⓓ Spices.

12 What is the part of brain that acts as a bridge between the spinal cord and the different parts of brain ?

ⓐ Hypothalamus. ⓑ Pons Varolii. ⓒ Cerebellum. ⓓ Midbrain.

13 Which of the following represents the first part of the sensory path ?

ⓐ Responding organ. ⓑ Muscle. ⓒ Skin. ⓓ Gland.

14 Which of the following represents the role of Schwann cells in the transmission of nerve impulse ?

ⓐ They nourish the axons of neurons.
ⓑ They decrease the speed of nerve impulse.
ⓒ They increase the speed of nerve impulse.
ⓓ They protect the nerve cell.

15 Which of the following its/their action is similar in animal with the action of stomata in plant ?

ⓐ Kidney. ⓑ Nephron. ⓒ Sweat gland. ⓓ Sweat pores.

16 Which of the following regions in the nervous system contain(s) higher amount of fat substances ?

ⓐ Synapse. ⓑ White matter. ⓒ Grey matter. ⓓ Ranvier's nodes.

EXAM 7

17 When exposing plants to heavy rains, what do you expect to happen for the stomata transpiration in these plants ?

(a) It decreases.
(b) It increases.
(c) There is no relation between them.
(d) It remains constant.

18 Which of the following leads to the resting potential of a neuron ?

(a) The equal distribution of ions inside and outside the cell.
(b) The membrane selective permeability to ions.
(c) The outflow of chloride ions.
(d) The increase in sodium ions permeability to inside.

19 What is the role of auxins in the phototropism of each of stem and root ?

(a) The auxins work in the same direction of the stimulus.
(b) The auxins get away from the stimulus.
(c) The auxins inhibit the growth of cells.
(d) The auxins stimulate the growth of cells.

20 From which of the following are the neurotransmitters released in the synapse between a neuron and a muscle fiber ?

(a) The dendrites of a nerve cell.
(b) The nerve cell body.
(c) The muscle fiber.
(d) The terminal arborizations of nerve cell.

## Answer the following questions (21 : 23) :

21 **Explain :** the skeleton has an important role in the protection of the central nervous system.

1 mark

22 **Explain :** the ways of excretion in herbaceous plants through the vegetative system are variable.

1 mark

23 **Mention the part that is responsible for regulating the following function :**

**(a)** Talking.

**(b)** Respiration mechanism.

# Exam 8

## Alexandria Governorate

"Middle Educational Zone"

### Choose the correct answer (1 : 20) :

1 The temperature of living organism is decreased by the action of .....

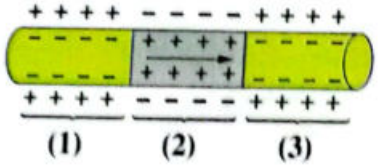
ⓐ transpiration only.

ⓑ urination only.

ⓒ transpiration or urination.

ⓓ transpiration or sweating.

2 The opposite figure represents a nerve cell, the potential difference will be +40 millivolt in part(s) .....




ⓐ (1) only. ⓑ (2) only. ⓒ (3) only. ⓓ (1) and (2).

3 Some of the following membranes surround the brain, but the membrane which protects it from mechanincal trauma is .....

ⓐ pia mater. ⓑ dura mater. ⓒ arachnoid. ⓓ neurolemma.

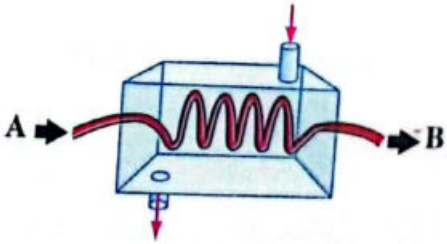
4 Which part is **not** affected when a person is subjected to high sound waves ?

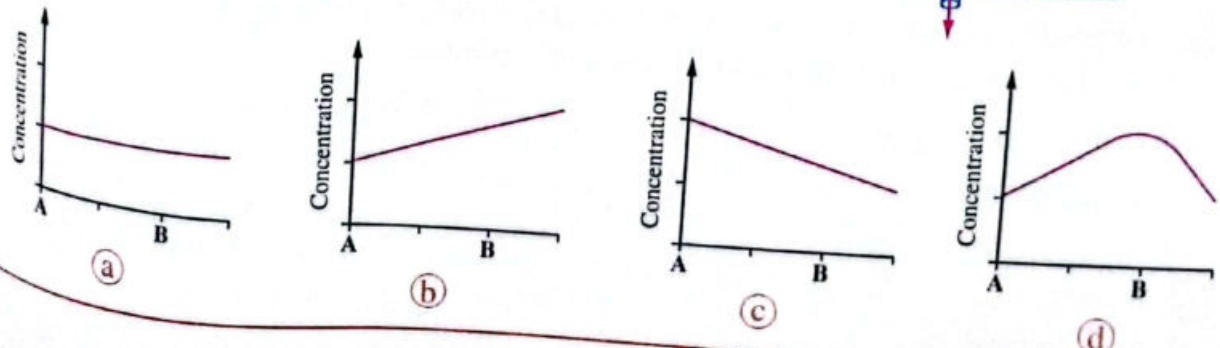
ⓐ Midbrain. ⓑ Cerebellum. ⓒ Cerebral cortex. ⓓ Thalamus.

5 By which of the following processes does the plant get rid of excess water ?

ⓐ Photosynthesis. ⓑ Guttation. ⓒ Catabolism. ⓓ Exudation.

6 Which of the following graphs represents the change in the concentration of thyroid gland hormone in the blood of a patient with kidney failure during its passage in artificial kidney apparatus ?



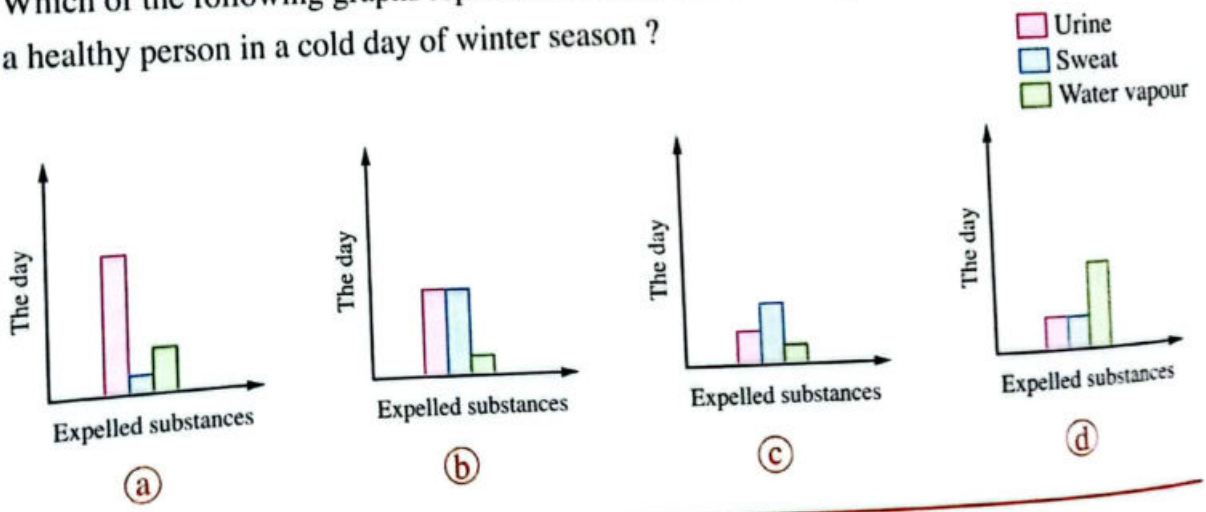



7 When does acetylcholine reach the post-synaptic membrane ?
ⓐ After the action of cholinesterase enzyme directly.
ⓑ Before the action of calcium ions directly.
ⓒ Before the action of sodium ions directly.
ⓓ After the action of calcium ions directly.

8 Urea is made in the human body by .....
ⓐ skin. ⓑ kidney. ⓒ liver. ⓓ lung.

9 In *Mimosa* plant, the structures that are similar in their function to joints in the human body are .....
ⓐ leaflets. ⓑ primary rachises. ⓒ secondary rachises. ⓓ pulvini.

10 Which of the following graphs represents the amount of the expelled substances from a healthy person in a cold day of winter season ?

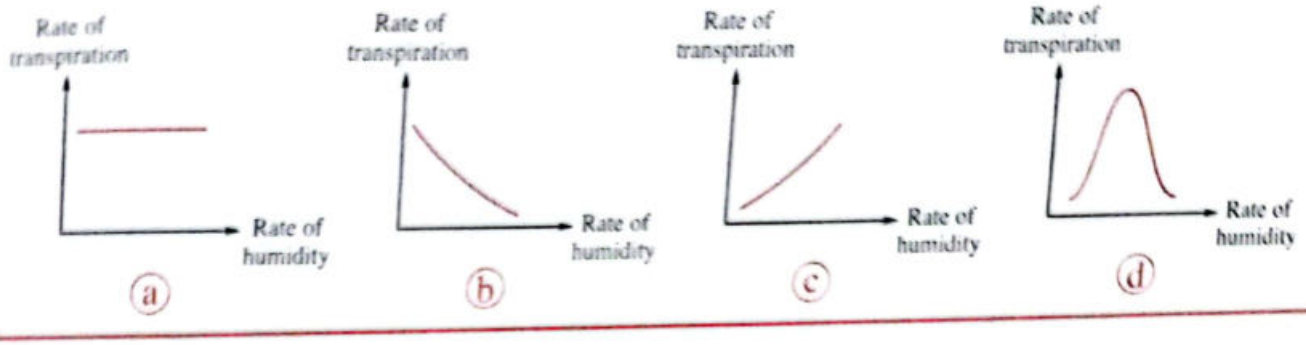



11 Myelinated nerve fibers conduct nerve impulses ..... the non-myelinated ones.
ⓐ equal to ⓑ faster than ⓒ slower than ⓓ faster or slower

12 In a healthy person, when the concentration of glucose in renal artery is clearly higher than that of renal vein. So, this indicates a disturbance in .....
ⓐ Bowman's capsule. ⓑ collecting duct.
ⓒ nephric tubule. ⓓ glomerulus.

13 During ....., the nerve cell doesn't respond to any stimulus whatever its strength.
ⓐ polarization ⓑ repolarization
ⓒ depolarization ⓓ refractory period

14 Which graph indicates the relation between the rate of air humidity and transpiration in plants ?

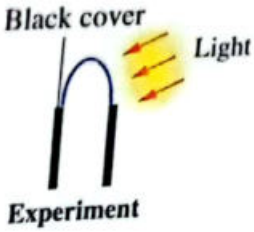



15 The nerve that connects the eye to the brain is .....
(a) mixed spinal. (b) mixed cranial. (c) motor cranial. (d) sensory cranial.

16 Occipital lobe in the cerebral hemisphere contains the centre of .....
(a) speech. (b) smell. (c) movement. (d) vision.

17 ..... are characterized by their ability to divide and repair some injured parts.
(a) Sensory neurons (b) Motor neurons
(c) Neuroglia (d) Connector neurons

18 The opposite figure represents an experiment on the oat *(Avena)* seedling coleoptile, what happens to it after several days ?



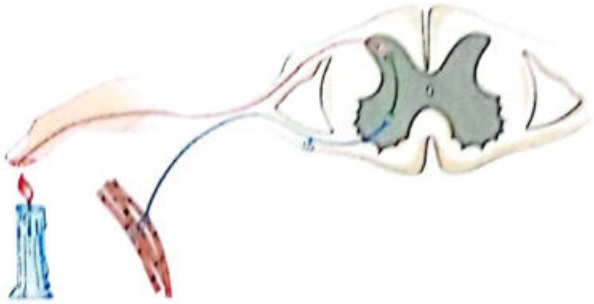

(a) Its growth stops.
(b) It grows and inclines towards the light direction.
(c) It grows and inclines opposite to the light direction.
(d) It grows vertically without any curvature.

19 From the functions of epidermis of human skin is .....
(a) air absorption. (b) excretion of gases.
(c) sweat production. (d) preventing the penetration of bacteria.

20 The nerve represents .....
(a) a dendrite of a neuron.
(b) non-myelinated axons.
(c) a group of covered nerve bundles.
(d) a collection of neurons' bodies forming the nerve cord.

## Answer the following questions (21 & 22) :

21 **Study the following figure that represents the reflex action, then answer the following question :**



Light candle

**What** is the type of this reflex action ? **(Give reason for your answer).**

2 marks

22 **Explain :** what happens if one human kidney is destroyed.

3 marks

## Choose the correct answer (1 : 20) :

1 Contraction occurs suddenly, when a hand touches a hot surface, which of the following controls this action ?

ⓐ Parietal lobe of cerebral cortex. ⓑ Spinal cord.
ⓒ Frontal lobe of cerebral cortex. ⓓ Occipital lobe.

2 Which of the following statements agrees with the refractory period ?

ⓐ The movement of sodium and potassium ions is stable.
ⓑ The number of ATP molecules decreases.
ⓒ The nerve cell can transmit a new impulse.
ⓓ It is completely similar to the resting time of the nerve cell.

3 One of the reasons for the ability of the skin to maintain the temperature of the body is .....

ⓐ the exit of water in the form of vapour from it.
ⓑ the exit of water in the form of a liquid from it, then evaporates.
ⓒ the accumulation of wastes on the pores.
ⓓ the lack of nitrogenous wastes in sweat.

4 Which of the following foods lead to the formation of much urea ?

ⓐ Foods rich in fats and poor in fibers.
ⓑ Foods poor in carbohydrates and rich in proteins.
ⓒ Foods rich in carbohydrates and poor in fats.
ⓓ Foods poor in fats and rich in fibers.

5 The hair becomes brittle in the absence of .....

ⓐ the sweat gland close to it. ⓑ melanin.
ⓒ the muscle that moves it. ⓓ the sebaceous gland surrounding it.

6 A person whose body contains 5 liters of blood, how many times approximately does the whole volume of blood pass through each kidney in 360 minutes ?

ⓐ 15 times. ⓑ 90 times. ⓒ 120 times. ⓓ 180 times.

7 Types of synapses are all of the following, **except** between .....

ⓐ two neurons. ⓑ a nerve cell and a muscle fiber.
ⓒ a muscle cell and another muscle fiber. ⓓ a nerve cell and a glandular cell.

8 Sweat in humans is different from transpiration water in plants in that it
(a) contains mineral salts.
(b) exits through the plasma membranes.
(c) reduces the temperature.
(d) increases its excretion with an increase in temperature.

9 ..... of a *Mimosa* plant would **not** exhibit any sort of movement as a part of the plant's unique response to touch.
(a) Leaflets (b) Rachis (c) Stem (d) Stoma

10 If you know that the loop of Henle works to reabsorb water from the nephrons to the blood, in which of the following living organisms the loop of Henle is absent or atrophied ?
(a) Lizards. (b) Desert rats. (c) Birds. (d) Freshwater fish.

11 The high concentration of auxins causes .....
(a) increasing in the root cells elongation.
(b) increasing in the root and stem elongation.
(c) decreasing in the stem cells elongation.
(d) inhibiting the root cells elongation.

12 Acetylcholine causes .....
(a) the increase in the permeability of the post-synaptic membrane for sodium and potassium ions to outside.
(b) the transmission of the nerve impulse through the synaptic areas.
(c) the formation of the electrical potential difference of the nerve cell at the resting state.
(d) the increase in the nerve cell depolarization.

13 Toxic substances are excreted outside the body through .....
(a) liver and kidneys. (b) skin and liver. (c) kidneys and skin. (d) lungs and liver.

14 What is the result of damage to the cerebellum ?
(a) Change in the body temperature.
(b) Rapid breathing.
(c) Memory loss.
(d) Loss of the body balance.

15 The artificial kidney device depends on the .....
(a) diffusion.
(b) imbibition.
(c) active transport.
(d) diffusion and active transport.

16 Hunger and sleep centres are located in the ..... area.
(a) midbrain (b) cerebellum (c) thalamus (d) hypothalamus

17 All of the following lead to an increase in the rate of transpiration in the day except
(a) an increase in the intensity of light and temperature during the day.
(b) an increase in the number of stomata.
(c) a decrease in the surface area and number of leaves.
(d) a decrease in the humidity in the air.

18 Which of the following do you expect to be highly decreased after the neuron exerts a high activity ?
(a) Mitochondria. (b) Nissl's granules. (c) Neuroplasm. (d) Golgi bodies.

19 What are the characteristics of the body parts that produce much more sweat ?
(a) They have many sweat glands and blood capillaries.
(b) They have many sweat glands and few blood capillaries.
(c) They have few sweat glands and blood capillaries.
(d) They have few sweat glands and many blood capillaries.

20 The areas of the nervous system that contain the most fatty substances are .....
(a) white matter. (b) grey matter. (c) synapses. (d) cyton.

## Answer the following questions (21 : 23) :

21 **Mention the site of presence of the following :**
(a) Cholinesterase enzyme.

(b) Glomerulus.

..... 2 marks

22 **What will happen when :** successive opening of sodium gates (channels) of neuron's axon takes place ?

..... 1 mark

23 **Give one example for :** the most common type of sensation in plants.

..... 1 mark

# Exam 10

## Aswan Governorate

"Aswan Educational Administration"

### Choose the correct answer (1 : 20) :

1 Sweat is secreted from the ..... tissue of the skin.

(a) epithelial (b) connective (c) muscular (d) nervous

2 The functional unit of the kidney that extracts urine is .....

(a) nephron. (b) cortex. (c) medulla. (d) ureter.

3 Cholinesterase enzyme works on ..... the impulse transmission.

(a) starting (b) stopping (c) increasing (d) decreasing

4 You were inside a building and suddenly someone shouted (fire), so you start running without thinking, what is the responding organ in this reflex action ?

(a) Heart muscle. (b) Ear muscle.

(c) Leg muscles. (d) Forearm muscles.

5 The blood of the kidney failure patient passes to the artificial kidney device through .....

(a) vein. (b) artery. (c) blood capillaries. (d) heart.

6 What is(are) substance(s) that is(are) used by *Mimosa* plant to respond to touch and darkness ?

(a) Nitrogen. (b) Auxins. (c) Water. (d) Oxygen.

7 Which of the following has(have) a role in repairing the injured parts of some neurons ?

(a) Dendrites. (b) Schwann cell. (c) Myelin sheath. (d) Neuroglia.

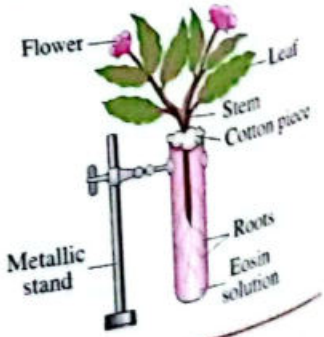
8 What does the opposite experiment represent ?

(a) Transpiration process.

(b) Products of photosynthesis.

(c) Transport of the sap through phloem.

(d) Transport of water and salts through xylem.



9 The living organism adapted with the environment by .....

ⓐ movement. ⓑ transport. ⓒ sensation. ⓓ excretion.

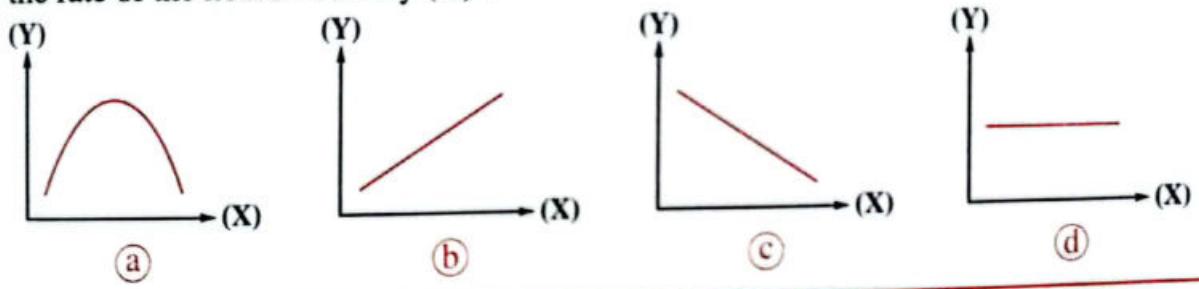
10 The concentration of auxins in the dark side of the plant stem is ..... the side facing light.

ⓐ less than ⓑ more than ⓒ equal to ⓓ different from

11 The skin colour is different from one person to another due to the different quantities of ..... in the skin.

ⓐ melanin ⓑ keratin ⓒ myelin ⓓ cutin

12 Which graph represents the relation between the amount of Nissl's granules (Y) and the rate of the neuron activity (X) ?




ⓐ ⓑ ⓒ ⓓ

13 Which of the following air components is **not** considered as an excretory product ?

ⓐ $CO_2$ ⓑ Oxygen. ⓒ Hydrogen. ⓓ Nitrogen.

14 From which of the following parts of the synapse are the neurotransmitters released ?

ⓐ Muscular fiber. ⓑ Dendrites.
ⓒ Terminal arborization. ⓓ Cell body.

15 The excreted water at the leaf tips of some plants in the early morning caused by .....

ⓐ exudation. ⓑ the presence of hydathode.
ⓒ transpiration. ⓓ stomatal transpiration.

16 What are the types of spinal nerves ?

ⓐ Sensory. ⓑ Motor.
ⓒ Mixed. ⓓ Motor and mixed.

17 The importance of the nerve cell axon is .....

ⓐ nourishing the neurons. ⓑ receiving the nerve impulses.
ⓒ applying neurons with the required energy. ⓓ transmitting the nerve impulses.

18 Which of the following human brain parts makes the body adapted to the changes in the environmental temperature ?

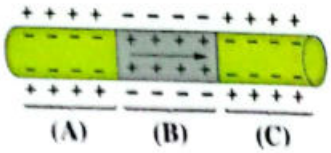
(a) The parietal lobe. (b) Cerebellum. (c) Thalamus. (d) Hypothalamus.

19 Which of the following foodstuffs is recommended for maintaining our kidney healthy ?

(a) Milk derivatives.
(b) Fruits and vegetables.
(c) Grains and legumes.
(d) Meat and poultry.

20 From the opposite figure :

What are the states of the nerve fiber membrane in the two regions (B) and (C) respectively ?

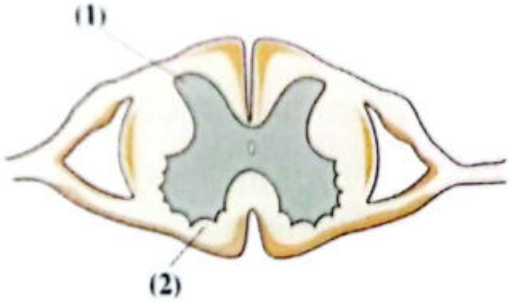



(a) Polarization and depolarization.
(b) Repolarization and depolarization.
(c) Depolarization and polarization.
(d) Depolarization and repolarization.

## Answer the following questions (21 & 22) :

21 **From the opposite figure :**

What are the differences between structure (1) and structure (2) ?




2 marks

22 **What happens in case of :** stopping the transpiration process in plant ?

2 marks